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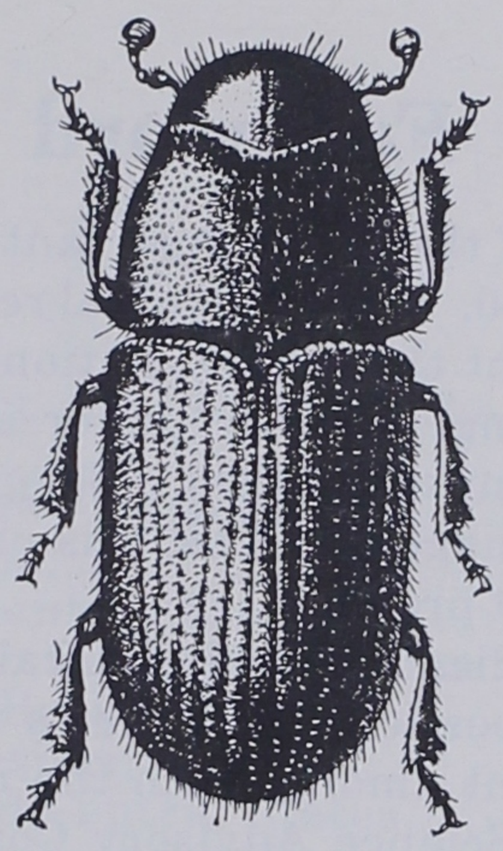

FOREST INSECT CONDITIONS

PSW FOREST AND RANGE
EXPERIMENT STATION
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IN THE UNITED STATES • 1963

FOREST SERVICE • UNITED STATES DEPARTMENT OF AGRICULTURE

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Foreword

This publication on the status of the more important forest insects in the United States is the 14th in a series that began in 1950. The individual reports of Forest Service entomologists in the various forest Regions present the annual national picture of forest insect conditions. Because these regional reports bring together under one cover the results of all Federal, State, and private cooperative measures utilized in keeping abreast of insect conditions, and of action programs for reducing damage and loss, this publication has become a handy reference for those interested in the insect problem.

In 1963, the American public indicated through local and national communications media its grave concern over the use of pesticidal chemicals for the control of insects. Reaction came from many sources, paramount among them the report on pesticidal chemicals by the late President John F. Kennedy's Science Advisory Committee. With potential hazards of pesticides in mind, all projects for control of forest insects were carefully screened by Pest Action Councils and Committees at the regional level, and in turn by the USDA Pest Program Evaluation Group and the Federal Pest Control Review Board at the national level. This multiple screening of proposed suppression projects insured the elimination of undue pesticide hazards to water, recreation, food and feed crops, fish and game, and human beings, as well as to the birds and other wildlife that make the forests their home. The Forest Service warns users that all pesticides are poisonous, that the directions and precautions on the containers should be closely followed, and that overdosing should be avoided in forest spraying, especially over and around streams, ponds, and lakes.

Also in 1963, significant progress was made in strengthening cooperative work among Federal and State Governments and private agencies to protect the resource values on non-Federal forest lands. Progress toward this end was accomplished by extending to States the cost-sharing provisions of the Federal Forest Pest Control Act that will help them in a continuing program of forest insect and disease detection and in evaluation surveys on non-Federal forest lands. This represents a significant step forward to reduce damage and loss caused by insects to the Nation's forests. As the States avail themselves of this opportunity to strengthen their work, survey and control activities will become intensified, and losses should be proportionately reduced.

In June 1963, Dr. Stephen L. Wood published the results of his taxonomic revision of the bark beetle genus *Dendroctonus* (Coleoptera: Scolytidae), Great Basin Naturalist 23(1 and 2): 1–117, illus. His study resulted in the recognition of but 14 valid species. In this report, however, previous names of species have been used.

Mention of commercial products and named pesticides does not imply endorsement by the U.S. Department of Agriculture, Forest Service.

Grateful acknowledgment is made to all those Federal, State, county, and private agencies whose assistance and cooperation made this compiled national report a reality. Comments on the report are welcome.

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Issued April 1964

FOREST INSECT CONDITIONS IN THE UNITED STATES, 1963

Highlights

The largest campaigns in more than a decade were undertaken in the United States in 1963 to suppress destructive forest insects. As a result, the scope and severity of infestations throughout the Nation were greatly reduced from levels of the past few years. Although there were many new outbreaks of bark beetles, defoliators, and other pests in 1963, few of them compared with the wide-scale epidemics of 1962. An improved pattern of precipitation in much of the West and South and an increase in natural factors that hold some species in check brighten the overall outlook for forest insect conditions expected in 1964. The most significant infestations in the various sections of the country, together with a comparison of the status of those persisting from prior years, and a discussion of major action programs utilized in suppression in 1963 are highlighted in the paragraphs that follow.

The situation in California

Forest insect conditions in California were variable. A material decline occurred in the 1961–62 epidemic of western pine beetle along the lower front of the Sierra Nevada. The area of infestation dropped from more than a million acres to less than 750,000. The decline in number of infested trees is estimated at more than 75 percent. The decline in area and severity of these infestations is attributed to the widespread salvage and chemical treatment of infested trees and to above-normal precipitation during the past 2 years. The longstanding epidemic of the fir engraver abated somewhat, but significant losses continued.

Populations of the spruce budworm declined sharply in the Warner Mountains, Modoc County, and losses caused by the Jeffrey pine beetle remained low in most areas of the State. In contrast, the mountain pine beetle continued its heavy toll of old- and young-growth sugar pine; the Douglas-fir tussock moth and the white fir sawfly increased substantially; and a 7,500-acre pandora moth outbreak occurred in stands of Jeffrey pine. Forest insect suppression was directed primarily against bark beetles in the Mother Lode area and in forest recreational areas in the central and southern part of the State.

The situation in the Pacific Northwest

On an overall basis, insect infestations in the forests of Oregon and Washington were less serious than those in 1962. The level of losses caused by bark beetles in ponderosa pine stands was less, due primarily to an increase in the tempo of logging in many affected areas. Concerted action by owners and managers of forest lands in rapidly salvaging the large volume of 1962 windthrown timber in the coastal forests of both States materially lessened the likelihood of future serious bark beetle epidemics.

Direct action to suppress the western hemlock looper on 70,000 acres in the vicinity of Naselle, Wash., prevented wholesale tree killing in that area and eliminated the threat posed by outbreak populations to adjacent stands. The European pine shoot moth was apparently eradicated from Spokane, Wash., and Salem, Oreg., and no new infestations, except in a nursery in Portland, Oreg., were found outside the Puget Sound Containment Zone. Direct control of the mountain pine beetle was continued at Crater Lake National Park, Oreg.

The situation in the Intermountain Area

Losses of forest resources attributable to several insect pests continued heavy throughout the Intermountain States. Bark beetles remained the worst offenders, but defoliators also were quite troublesome. The long-standing epidemics of mountain pine beetle in stands of lodgepole pine on the Wasatch National Forest and at other locations in Utah, and in Wyoming, have been largely checked by sustained large-scale suppression programs. Mountain pine beetle infestations on the Teton and Targhee National Forests and Grand Teton National Park, however, continued unabated despite suppression efforts, and large increases in populations developed anew in stands of lodgepole pine in parts of Sublette County, Wyo., and Bingham County, Idaho. For the first time in many years, Engelmann spruce beetle infestations were reduced to endemic levels. Damage caused by the Douglas-fir beetle also was less than at any time in the past decade. Tussock moth outbreaks were widespread on a variety of host species in southern Idaho and Nevada, and localized infestation of other miscellaneous species occurred at scattered locations throughout the Intermountain States.

The spruce budworm epidemic in Idaho continued and the gross area of defoliation amounted to approximately 1.6 million acres. A start was made to suppress the budworm in 1963 by aerial spraying 190,000 acres. It is planned to spray an additional one-half million acres in 1964, and if needed, to treat the residual infestations in 1965.

The situation in the Northern Rocky Mountains

Foliage feeders were the most troublesome insects in the Northern Rocky Mountains. The wide-scale infestations of spruce budworm continued in Montana and north Idaho and light to severe defoliation occurred again on a gross area of approximately 2.25 million acres. Aerial spraying for control of the budworm was completed successfully on 410,600 acres of heavily infested timber in western Montana, and it is planned to treat other severely affected stands in 1964.

The larch casebearer, a relative newcomer to the Northern Rockies, continued its spread in western Montana, north Idaho, and northeastern Washington. Effective parasites of the casebearer have become established in Idaho and efforts will be increased to hasten their establishment throughout the general area of infestations. The Douglas-fir tussock moth showed signs of increasing in north Idaho, and outbreaks there are a possibility in the future. Chronic infestations of mountain pine beetle continued in stands of white pine on the Clearwater National Forest, Idaho, but other bark beetles were less of a problem than for the past several years.

The situation in the Central Rocky Mountains

The Black Hills beetle was the dominant pest in the Central Rocky Mountains and in the Black Hills of South Dakota and Wyoming. In the latter area a large-scale epidemic, the worst in many years, destroyed thousands of ponderosa pines. The virulence of the epidemic prompted an all-out campaign by landowners in suppression and containment during the fall of 1963, and control of the epidemic is expected by mid-year in 1964. Elsewhere in the Central Rockies, Black Hills beetle infestations were largely contained by direct control action. The spruce budworm declined substantially from natural causes in most areas in Colorado, and for the first time in many years Engelmann spruce beetle infestations also were largely endemic.

The situation in the Southwest

Cultural, direct, and natural controls resulted in less damage and loss by insects to forest values in the Southwest than at any time during the past 5 years. Infestations of the Engelmann spruce beetle in northern New Mexico have been reduced materially by sustained action in selling infested trees and burning infested slash and cull material. The 2-year control program directed against the 1.1-million-acre epidemic of spruce budworm greatly reduced the area of infestations. However, two new infestation centers totaling 100,000 acres were discovered in southern New Mexico in 1963, and some 350,000 acres outside of the control zone in northeast New Mexico harbor outbreak populations. Direct control of the spruce budworm is not planned in 1964.

The situation in the Lake, Central, and Northeastern States

A variable pattern of infestations characterized forest insect conditions in the Lake, Central, and Northeastern States. Natural factors reduced outbreak populations of the saddled prominent, pitch pine looper, linden looper, and forest tent caterpillar in the Northeastern States, and the more commonly important defoliators were less abundant in the Lake and Central States, largely because of natural control factors. Spring and fall cankerworms defoliated oaks and hickories at many locations, and the gypsy moth was a problem in Massachusetts, New York, New Jersey, and Pennsylvania.

Aerial spraying by the States and the Agricultural Research Service of the USDA for control of gypsy moth totaled 342,400 acres. The spruce budworm epidemic in Maine was controlled on 475,000 acres by spraying, and only 50,000 additional acres will need treatment in 1964. The intensity of spruce budworm infestations in northern Minnesota remained static, with no further spread to the south or east. Direct control of the budworm in Minnesota was limited to heavily infested areas in high-value recreational sites.

The beech scale and the associated *Nectria* fungus continued as serious threats to mature beech stands in Maine, New Hampshire, Vermont, and New York. The white pine weevil, balsam woolly aphid, and red pine scale remained at damaging levels in the Northeast. Similarly, Saratoga spittlebug, European pine shoot moth, and European pine sawfly were destructive in local areas in the Central and Lake States.

The situation in the South and Southeast

In the South and Southeast, infestations of all but a few forest insects were greatly reduced from previous years. The decline of southern pine beetle populations, first observed in east Texas in 1962, continued there, and infestations in most other affected areas in Alabama, Mississippi, Georgia, and the Carolinas also were brought under control in 1963. At year's end all but a few southern pine beetle infestations were on the wane, and no serious tree killing over extensive areas is expected in 1964.

The long-standing outbreak of elm spanworm in the southern Appalachian Mountains began a natural decline in 1963, and a continued decrease in populations is predicted for 1964. Black turpentine beetle activity continued at previous high levels with the greatest populations in the Gulf States area. Direct control of this beetle was required in all affected areas.

Forest Insect Conditions in the Various Regions

OREGON AND WASHINGTON

By P. W. ORR, Division of Timber Management, Portland, Oregon

Conditions in Brief

Size of insect outbreaks increased slightly over those recorded in 1962. The total area of infestation was 1,311,085 acres. Bark beetle infestations accounted for most of this total. Defoliator infestations were static while those of sucking insects increased significantly.

Mountain pine beetle infestations in western white pine stands caused heavy tree losses, particularly in the Cascade Mountains in both States. Salvage logging was stepped up to remove all merchantable pines on an area basis. The trend of other bark beetle infestations varied with the species but was generally downward.

Infestations of the European pine shoot moth have apparently been eradicated in Spokane, Wash. No new infestations were found in 1963. In Portland, Oreg., eight infested trees were found and destroyed. The outlook for eradication in Portland is encouraging. Within the containment zone in Washington, infestations are widespread and eradication is impractical.

The success of the 1963 western hemlock looper control project in southwestern Washington varied considerably by area, depending upon the insecticide used. DDT produced uniformly high larval mortality while Sevin produced low, variable larval

mortality. Sevin, Phosphamidon, and *Bacillus thuringiensis* were tested against the looper under field conditions. Phosphamidon results were marginal, indicating the need for further testing. The present formulations of Sevin and *Bacillus thuringiensis* were unsatisfactory.

Heavy concentrations of Douglas-fir timber windthrown by the October 12, 1962, hurricane and subsequent storms remain in the woods despite concerted salvage efforts. Much of this blowdown material has been attacked by the Douglas-fir beetle that may emerge to attack and kill standing timber in 1964.

No large-scale chemical control project appears to be necessary to control forest insects in Oregon and Washington in 1964. A small maintenance control operation against the mountain pine beetle in lodgepole pine in Crater Lake National Park, Oreg., will be continued as needed.

Status of Insects

Spruce budworm, *Choristoneura fumiferana* (Clem.). Defoliation by the spruce budworm in Oregon was confined to true fir and Douglas-fir stands on the Fremont and Wallowa-Whitman National Forests. In Washington, light to moderate defoliation of Douglas-fir, true fir, western hemlock, and Engelmann spruce occurred on the Kaniksu National Forest, north of Newport. The 1963 biological evaluation survey showed that a significant reduction in the 1964 larval population will occur, resulting in much lighter defoliation at the older infestation centers. Control is not considered necessary.

Western oak looper, *Lambdina fiscellaria somniaria* (Hulst). Defoliation of Oregon white oak increased considerably in the Willamette Valley of Oregon. A virus disease decimated larval populations in some areas late in the summer. By fall many trees had put out new foliage. The apparent trend of damage is downward. Because of the increase in the prevalence of disease and the past history of short-lived outbreaks, no control is needed in 1964.

Larch casebearer, *Coleophora laricella* (Hbn.). Epidemic infestations increased in size and severity in western larch stands in northeastern Washington. Much of this insect's damage is centered around Spokane, but subepidemic defoliation occurred at many other spots nearby. Although growth has been reduced as much as 40 to 50 percent in some instances, no tree mortality has occurred. Imported parasites were liberated near St. Maries, Idaho, in 1960. Progeny of these parasites were found in 1962 and 1963, but they are not yet abundant enough to exert effective control on the casebearer. Direct control is unnecessary in 1964.

Sawfly, *Neodiprion fulviceps* complex Ross. Localized outbreaks occurred on knobcone pine and ponderosa pine on Thorn Mountain, near Thorn Prairie, and in the Deer Creek drainage on the Umpqua National Forest, Oreg. Defoliation ranged from light to heavy the last 2 years, but no tree mortality has yet occurred. Starvation or some other physiological factor caused considerable larval mortality prior to pupation in the knobcone pine stands and to a lesser degree in the ponderosa pine stand, indicating a reduction in 1964 feeding population. Control is unnecessary.

Pandora moth, *Coloradia pandora* Blake. Light to heavy defoliation occurred in lodgepole pine stands on Skookum Butte east of Chemult, Oreg., on the Winema National Forest. No tree mortality has occurred despite heavy feeding by second-year larvae. Elsewhere in the same general area, second-year larvae were common but not abundant. Subepidemic larval populations were also found at an old infestation center near Sisters, Oreg., on the Deschutes National Forest. Past experience has shown that mammalian predators destroy a large number of the overwintering pupae, particularly in areas where ground litter is light. Hence, a survey to determine the need for control will be made during the spring months.

Douglas-fir tussock moth, *Hemerocampa pseudotsugata* McD. Epidemic outbreaks occurred in numerous farm woodlots near Spokane, Wash. Douglas-fir, grand fir, ponderosa pine, and spruce in these woodlots were defoliated. Some trees have already been killed and many more are threatened. So far, no infestations have developed in forest stands. However, the infested woodlots pose a threat to surrounding forest stands because the light buoyant first instar larvae are often blown great distances by the wind. These outbreaks are apparently related to the general upward cycle of this insect in the West the past 2 years. Evaluation surveys show that the infestation trend in northeastern Washington is upward and that additional defoliation and tree mortality is likely in 1964. Outbreaks of this insect are frequently brought under control rather quickly by disease and parasites. Hence, control to protect significant timber values will be unnecessary in 1964. However, some

landowners may wish to protect ornamental trees or small stands. The trend of this outbreak will be followed closely in 1964 for signs of increasing damage.

Sawfly on larch, *Neodiprion* sp. Small infestation centers of an undetermined sawfly developed in western larch on the Wallowa-Whitman National Forests in Oregon. At these centers, the defoliation ranged from light to heavy, but no tree killing occurred. Control is unnecessary, since larch will apparently tolerate considerable defoliation without severe effects.

Larch looper, *Semiothisa sexmaculata* (Pack.). Light to moderate defoliation occurred on western larch stands near Northport, Wash., on the Colville National Forest. A similar outbreak occurred in the same area in 1961 and subsided without causing any lasting damage. Control is not recommended.

Pine needle sheath miner, *Zelleria haimbachi* Busck. This insect caused widespread subepidemic defoliation on many different species of pine in Oregon and Washington. Both forest and ornamental trees were attacked. Parasitism was generally heavy. The insect is not known to kill trees, and control will be unnecessary.

Western hemlock looper, *Lambdina fiscellaria lugubrosa* (Hulst). Light to heavy defoliation of western hemlock continued in stands near Astoria, Oreg., that had been sprayed in 1962. Logging is progressing rapidly in the heavier centers of defoliation. Consequently, control is unnecessary in 1964. In Washington, defoliation ranging from light to heavy occurred on various areas within the 1963 control area near Naselle, Wash.

Most of the defoliation and tree killing in Washington occurred on areas within the boundaries of the 1963 control project that were sprayed with Sevin, *Bacillus thuringiensis*, or left unsprayed as check areas.

About 70,000 acres of mixed hemlock type in Pacific and Wahkiakum Counties, Wash., were sprayed to control the looper in 1963. The chlorinated hydrocarbon, DDT, was used on lands draining into the Columbia River and the carbamate, Sevin, was applied to lands draining into Willapa Bay to protect valuable shellfish and fisheries. Phosphamidon, Sevin, and *Bacillus thuringiensis* were tested on study areas under operational conditions.

All spraying was done by helicopter to control spray drift and avoid possible contamination of streams. Water conditions will be monitored through the winter and into the summer for water purity and to observe the long-term effects of the spray on the stream fauna. Operationally, DDT killed 98 percent of the larvae while Sevin killed only 43 percent, with a range of 0 to 87 percent.

Other insecticides that had shown some promise in the laboratory were tested under field conditions in an attempt to find an effective insecticide with a short residual life. On the average, the organic phosphate Phosphamidon killed 91 percent of the looper larvae, the carbamate Sevin killed 43 percent, and the bacterium *Bacillus thuringiensis* killed only 25 percent of the larvae on the test plots.

Low larval mortality from the use of Sevin is likely to result in additional defoliation and tree killing in 1964, particularly in heavily infested areas. Unless the population trend changes dramatically, 1964 larval feeding is likely to increase, particularly in the heavily infested areas in southwestern Washington.

European pine shoot moth, *Rhyacionia buoliana* (Schiff.). Results of the cooperative eradication surveys in Spokane, Wash., were negative for the second consecutive year. Eight infested pines were found in Portland, Oreg., and were destroyed with the owners' permission. Infestations increased considerably on ornamental pines within the containment zone in northwest Washington. Previously unknown infestations were discovered in 25 more communities near Seattle, Wash. Outside the containment zone, 42 communities were surveyed in Washington and 28 in Oregon—all with negative results. East of the Cascade Mountains, Canadian forest entomologists found the shoot moth on a native ponderosa pine at Summerland, in the Okanagan Valley of British Columbia. Although this is only a single record, it shows that the shoot moth is capable of surviving on ponderosa pine in the tree's natural range.

The long-term needs and policies concerning eradication, control, and research on the shoot moth in the Northwest are expected to be determined in 1964. These decisions may have a considerable influence on future pine management plans in the West.

Balsam woolly aphid, *Chermes piceae* (Ratz.). The infested acreage increased considerably in both States in 1963. The majority of the damage occurred in subalpine fir stands on the Mt. Hood, Willamette, Deschutes, Umpqua, and Rogue River National Forests in Oregon and on the Gifford Pinchot and Snoqualmie National Forests in Washington. The aphid has extended

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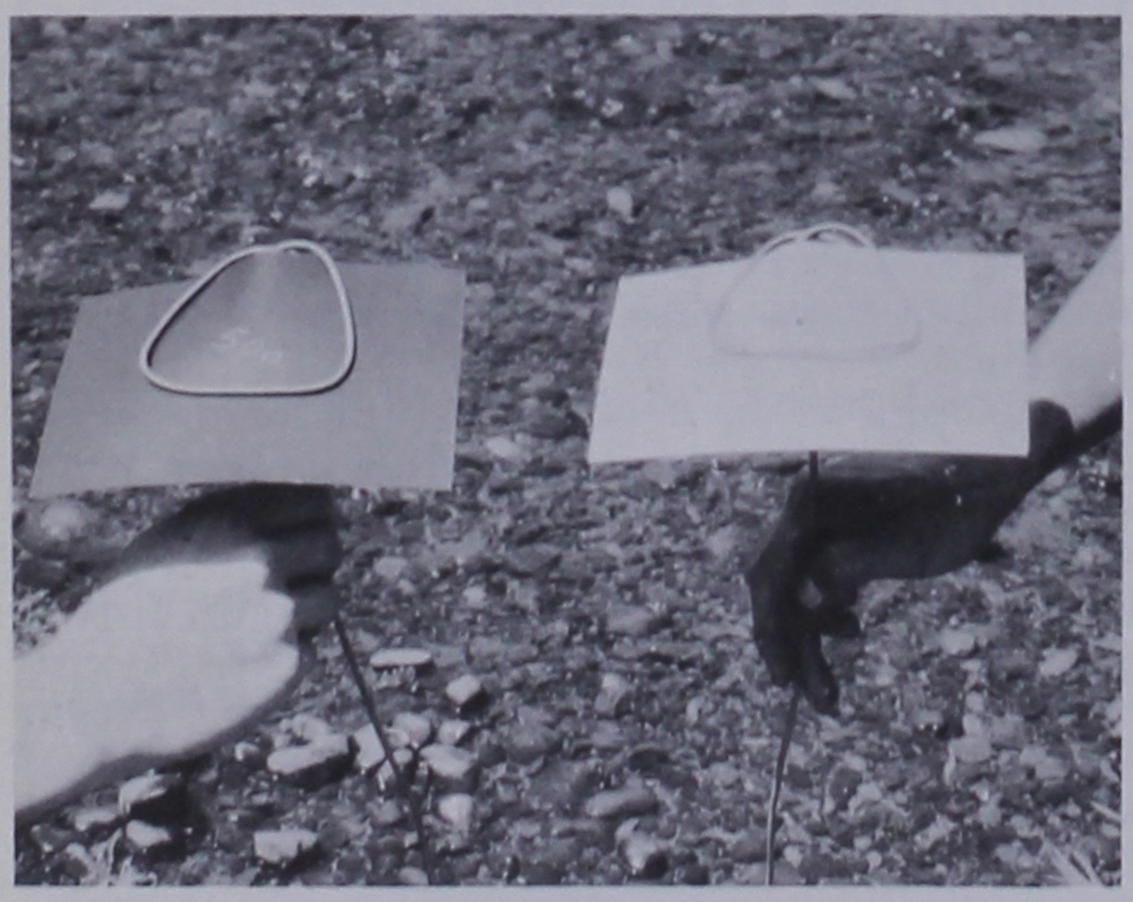
The effectiveness of a charcoal filter for removing DDT from water was tested in conjunction with the control project against the western hemlock looper in Washington. Further research and testing is needed and planned.



F–505843

Spray deposits were carefully checked during the 1963 project to control the western hemlock looper in Washington. The black card (left) was used for visual determination of spray coverage. White filter paper (right) was used for a chemical analysis of the spray deposit.

its range southward and is now well established in the upper Rogue River drainages and Crater Lake National Park in Oregon. Subepidemic tree mortality occurred at widely scattered points in grand fir and Pacific silver fir stands in western Oregon and southwestern Washington.

The 1964 damage trend is expected to be slightly upward in Pacific silver fir and grand fir stands. More severe and widespread tree killing is also expected in subalpine fir stands in the Cascade Mountains next year.

Logging infested trees and those of declining thrift is about all that can be done in the way of control under forest conditions. No direct controls have been developed. Colonization and liberation of foreign insect predators of the aphid were continued in 1963. Five of the imported species released have become established, but their effectiveness in controlling the aphid populations is still unknown.

F–505848

Heavy bole infestation of the balsam woolly aphid on a small young subalpine fir. Willamette National Forest, Oreg.

F–505846

Subalpine fir twig gouted and killed by the balsam woolly aphid. Willamette National Forest, Oreg.

Mountain pine beetle, *Dendroctonus monticolae* Hopk. In western white pine stands, tree killing decreased slightly in Oregon but increased considerably in Washington. The bulk of the damage occurred on the Gifford Pinchot, Wenatchee, Mt. Baker, and Olympic National Forests and in Olympic National Park in Washington. The heaviest outbreaks in Oregon were centered on the Mt. Hood, Willamette, and Umpqua National Forests. Logging infested trees and unattacked susceptible trees in distressed areas is being accelerated wherever possible to reduce the beetle populations and save timber.

The heaviest losses in lodgepole pine stands occurred on the Winema, Fremont, and Deschutes National Forests in Oregon and on the Gifford Pinchot, Colville, and Okanogan National Forests in Washington. Salvage of infested trees is being carried out wherever economically feasible.

Mortality in stagnated ponderosa pole stands increased in Oregon where losses were centered on the Wallowa-Whitman, Fremont, and Umatilla National Forests. A few centers of mortality developed on the Wenatchee, Umatilla, and Colville National Forests in Washington.

Increased tree killing is expected in western white pine stands, but less damage is predicted in lodgepole pine and ponderosa pine stands in both States in 1964.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. West of the Cascades in Oregon and Washington, tree killing was normal. East of the Cascade Mountains, outbreaks were centered on the Wallowa-Whitman National Forests in Oregon and on the Okanogan National Forest in Washington.

Of the estimated 17 billion board feet of blowdown timber resulting from the October 12, 1962, and subsequent storms, only 4 billion board feet has been salvaged. The remaining 13 billion board feet, much of it Douglas-fir, is likely to remain in the woods until the summer of 1964.

Much of the windthrown Douglas-fir has been attacked by the beetle, but it will not be known whether a widespread epidemic will develop in standing timber until next summer. In the meantime, infested windthrown trees will be salvaged as rapidly as possible to reduce beetle populations.

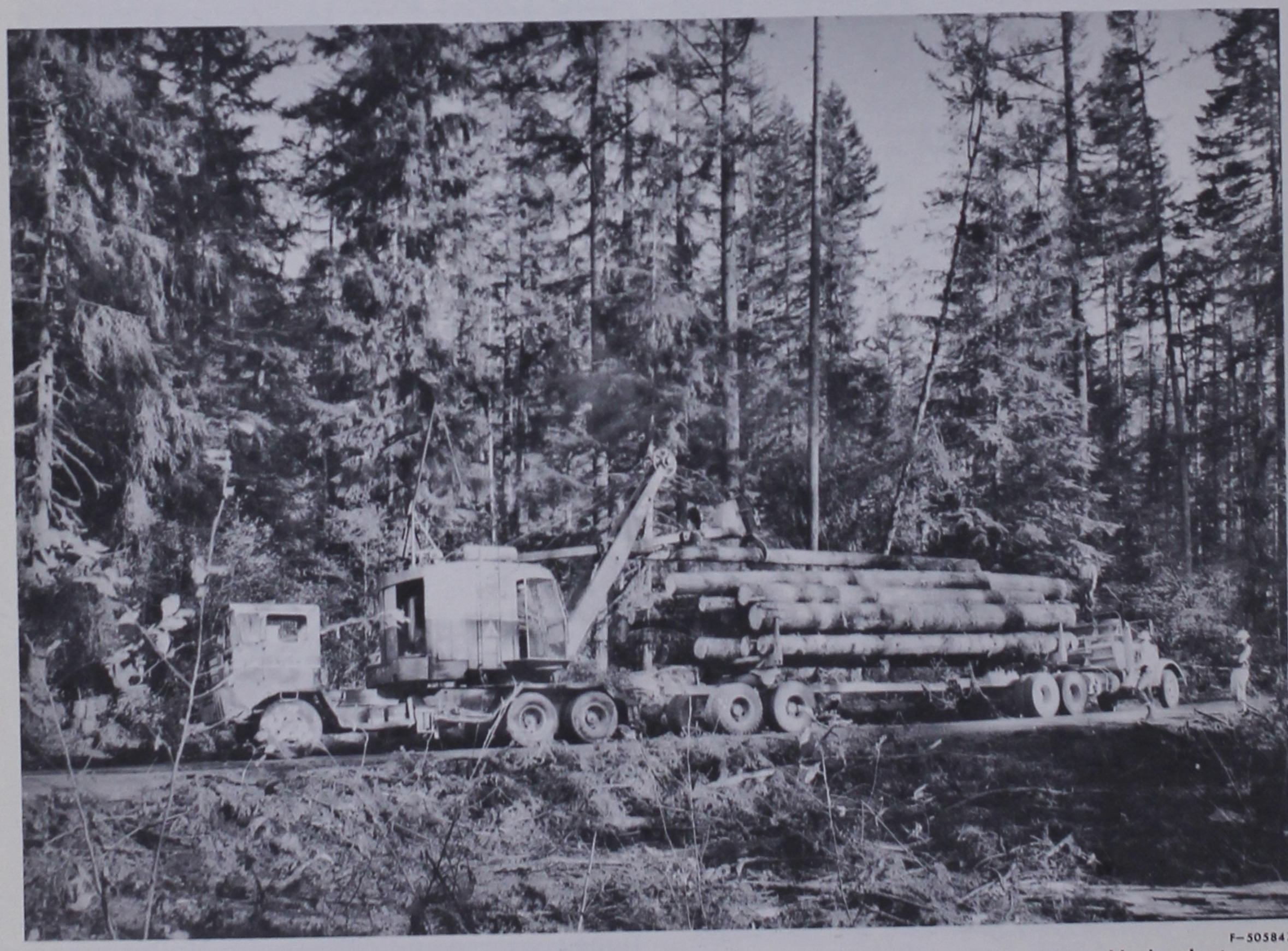
Western pine beetle, *Dendroctonus brevicomis* LeC. Tree mortality in mature ponderosa pine stands decreased in extent and intensity. Most of the remaining infestations occurred on the Fremont, Malheur, and Winema National Forests in Oregon and on the Yakima Indian Reservation and sur-

rounding timberlands in Washington. The lighter losses in 1963 were due, in part, to more favorable growing conditions during 1962. No epidemic outbreaks occurred near any of the concentrations of blowdown resulting from the October 12, 1962, storm. Lighter losses are expected in most areas next year. Aggressive sanitation-salvage programs are now underway in areas having a history of western pine beetle damage.

Fir engraver, *Scoyltus ventralis* LeC. Epidemic losses in lowland white fir, white fir, and subalpine fir decreased in extent and severity. In Oregon, most of the damage occurred on the Fremont, Wallowa-Whitman, and Umatilla National Forests. In Washington infestations were centered on the Wenatchee and Okanogan National Forests. In both States much of the distressed timber is unmerchantable and inaccessible. Outbreaks generally develop following drought periods and losses decrease when moisture conditions return to normal. Control is unnecessary. Salvage of infested merchantable timber is recommended.

Silver fir beetles, *Pseudohylesinus* spp. Outbreaks of these beetles resulted in increased mortality of Pacific silver fir in northwestern Washington forests. Heaviest losses occurred on the Mt. Baker and Snoqualmie National Forests. Light tree killing was detected in Mt. Rainier National Park and on the Gifford Pinchot National Forest. Although the losses are substantial, they remain well below the estimated 2 billion board feet of Pacific silver fir killed between 1947 and 1955 in the same general areas. Many of the trees attacked by the beetles are also infected with a root rot, *Armillaria mellea.* Increased mortality is expected in 1964. Logging dead and dying trees in the distressed areas during the winter is expected to produce some degree of control.

Oregon pine ips, *Ips oregonis* (Eichh.). Infestations on Washington forests increased



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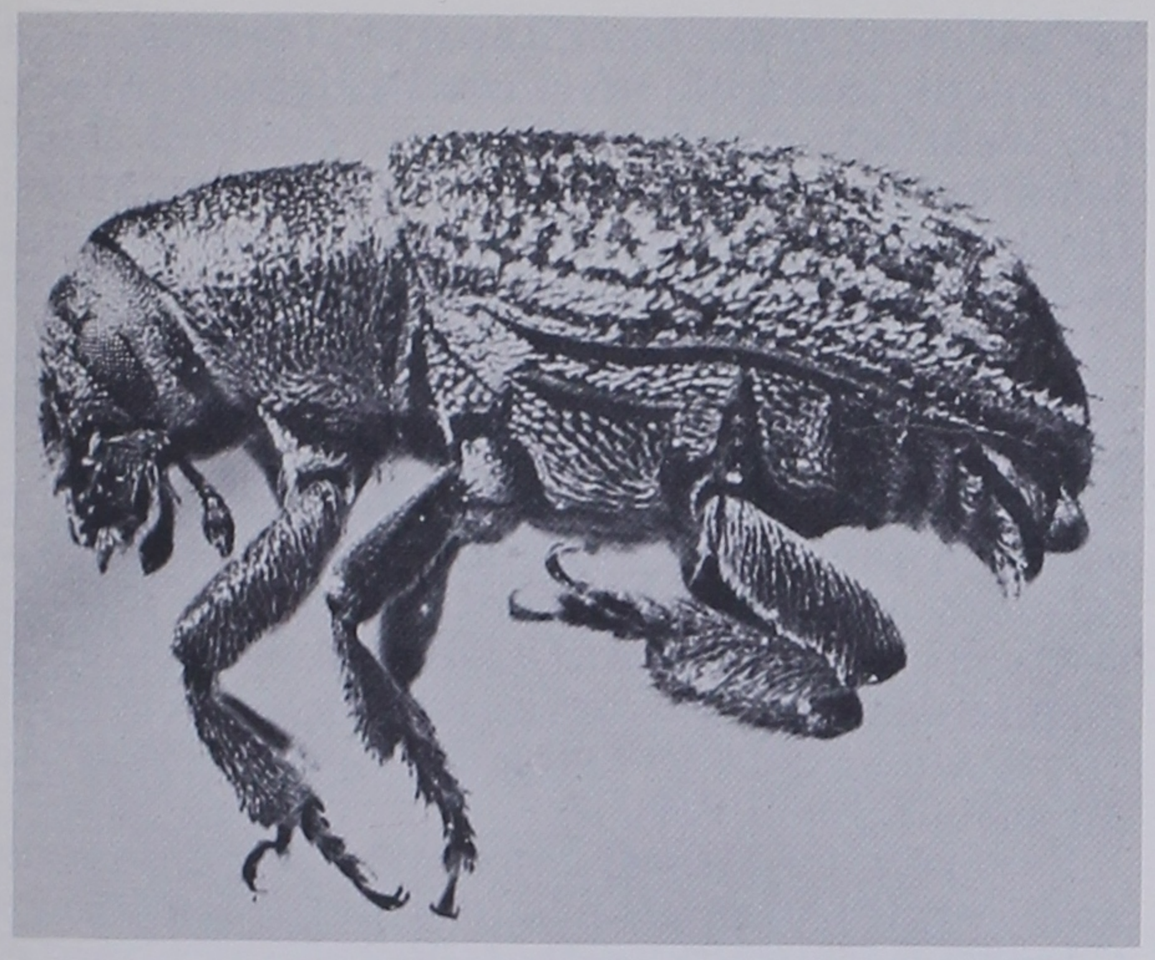
The salvage of windthrown Douglas-fir from the coastal forests in Oregon and Washington reduced the threat posed by beetles to green standing trees in affected stands.



F–494373

The silver fir beetle is a serious pest of true firs in parts of Oregon and Washington.

F–494376

Silver fir beetle gallery and the root rot fungus, Armillaria mellea, in Pacific Silver fir. Gifford Pinchot National Forest, Wash.

slightly while those on Oregon forests decreased. The largest and most severe losses occurred in young ponderosa pine sapling stands on the drier sites on the Malheur and Wallowa-Whitman National Forests in Oregon and on the Yakima Indian Reservation in Washington. Less damage is expected to occur next year. Good management practices usually preclude the need for control.

Engelmann spruce beetle, *Dendroctonus engelmanni* Hopk. Outbreaks in mature Engelmann spruce stands increased slightly in Oregon and Washington forests. Most of the damage was centered on the Okanogan and Umatilla National Forests in Washington and on the Wallowa-Whitman National Forests in Oregon. Much of the distressed timber is in undeveloped areas and control by logging infested trees is difficult. A slightly upward damage trend is predicted in both States for 1964. Other than logging infested trees in accessible areas, no control is necessary in 1964.

Douglas-fir engraver, *Scolytus unispinosus* LeC. A minor amount of tree killing occurred at light epidemic areas centered on the Wallowa-Whitman National Forests in Oregon and on the Snoqualmie National Forest in Washington. Most of the damage occurred in young Douglas-fir stands growing on dry sites. No control is necessary in 1964.

Other insects. An unknown spider mite caused light damage to Douglas-fir in northeastern Oregon on the Wallowa-Whitman National Forests. Sagebrush over extensive areas of eastern Oregon ranges was defoliated by the sagebrush defoliator, *Aroga websteri* Clarke, early in the summer. Many of the sagebrush plants had refoliated by fall. An accompanying heavy larval parasitism indicates that less damage is likely to occur in 1964. The forest tent caterpillar, *Malacosoma disstria* (Hbn.), feeding was heavy on red alder and other broad-leaved trees in various places in western Oregon. Attacks of the red turpentine beetle, *Dendroctonus valens* LeC., killed several residual trees on a precommercial ponderosa pine thinning area in eastern Oregon. Cone crops were poor in most parts of Oregon and Washington. Cones that did develop were heavily attacked by a number of insects, depending upon the tree species.

CALIFORNIA

By GEORGE L. DOWNING, Division of Timber Management, San Francisco, California

Conditions in Brief

There was a notable decline in western pine beetle populations in the Mother Lode in-

festation, an outbreak that extends throughout most of the ponderosa pine stands from Placer County south to Kern County. The decline is believed due primarily to the widespread logging and chemical treatment of infested trees and to above-normal precipitation during the past 2 years. The statewide epidemic of the fir engraver in true fir stands abated somewhat, but significant losses continued at many locations. The mountain pine beetle continued to take a heavy toll of old- and young-growth sugar pine in the southern Sierra Nevada and in young-growth ponderosa pine in Modoc County. Defoliation by the Douglas-fir tussock moth and the white-fir sawfly increased substantially in white fir stands in many counties in the central Sierra Nevada and in northeastern California. A pandora moth outbreak in Jeffrey pine caused light to almost complete defoliation on a 7,500-acre area in Tulare and Kern Counties. Spruce budworm populations declined sharply in white fir stands in the Warner Mountains, Modoc County. Jeffrey pine beetle populations remained low in most areas. Several insects were involved in widespread defoliation of bitterbrush, sagebrush, and other range plants in northeastern California.

Most of the timber blown down in the 1962 Columbus Day storm was salvaged, thus averting much of the potential danger of an insect buildup. Surveys of the unsalvaged blowdown found light insect populations in the pine but high populations of the Douglas-fir beetle in Douglas-fir.

Elsewhere in the State there were local infestations of the pine reproduction weevil, needle sheath miner, and a pine tip moth in pine plantations; the red turpentine beetle in thinned pine stands; the fall webworm in hardwoods; the black pine leaf scale on sugar pine; grasshoppers on ponderosa pine; a needle midge in a Douglas-fir plantation; and sawflies on pinyon pine.

Status of Insects

Western pine beetle, *Dendroctonus brevicomis* LeC. There was a definite decline in the Mother Lode infestation, an outbreak that includes over 1 million acres of ponderosa pine on the west side of the central and southern Sierra Nevada. An extensive survey of a part of the area in the fall of 1963 found an estimated 119,000 currently infested trees on 737,000 acres. This represents a reduction in infested trees of over 75 percent compared with that in 1962. The decline in tree losses is believed due to intensive logging and chemical control of insect-infested trees, to weather conditions that favored host resistance, and to several effective predators. Despite the overall reduction in tree killing, many areas sustained moderate to heavy loss.

Elsewhere in northern California losses were generally low except in localized parts of Glenn and Modoc Counties.

In southern California, damage by the western pine beetle remained relatively low in most maintenance control areas. Exceptions were the Arrowhead and San Jacinto maintenance control areas where an increased effort was made to bring tree losses down to an acceptable level.

Severe tree killing continued in ponderosa and Coulter pine stands at Julian, San Diego County, and Lake Hemet, Riverside County. No attempt was made to suppress these outbreaks.

Mountain pine beetle, *Dendroctonus monticolae* Hopk. There was a continued heavy loss of young-growth sugar pine in the Miami Creek area of Mariposa and Madera Counties, and efforts were made to log the larger infested trees and to make green pole sales to reduce the stocking in the overcrowded stands. Moderate losses in young-growth sugar pine were also occurring in one area in Fresno County.

Loss of mature sugar pine increased in the central Sierra Nevada, and losses remained epidemic in the southern Sierra Nevada. An outbreak in the south Warner Mountains, Modoc County, resulted in ponderosa pine losses of 8.1 million board feet on 22,000 acres in 1963. Additional high pine losses were sustained in this same area from outbreaks of the western pine beetle and Jeffrey pine beetle.

Populations of this beetle remained endemic in southern California.

Fir engraver, *Scolytus ventralis* LeC. The statewide epidemic of the fir engraver in true fir stands continued at a fairly high level, but insect populations were lower than those of 1962. No satisfactory control measures have been developed for this insect, but currently infested trees were logged in local areas in an attempt to reduce losses.

Douglas-fir tussock moth, *Hemerocampa pseudotsugata* McD. This tussock moth caused light to heavy defoliation of white fir on 20,000 acres at Knox Mountain, Modoc County; on 80 acres at Peddler Hill, Amador County; and on 600 acres at Iron Mountain, El Dorado County. A survey of the latter two areas found low overwintering insect

populations; this was due probably to heavy parasitism of mature larvae and pupae.

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The Douglas-fir tussock moth defoliated stands of white fir at three locations in northern California. Mature tussock moth larvae illustrated above.

White-fir sawfly, *Neodiprion abietis* complex (Harris). A general increase in sawfly populations occurred in white fir stands at several locations in northern and central California. Heavy defoliation seriously curtailed the harvesting of Christmas trees on part of a 22,000-acre infestation in Modoc County. The private landowners involved may attempt direct control of the outbreak in 1964, depending on the results of a biological evaluation of the problem.

Other infestations were reported from Tuolumne, Calaveras, Lassen, Modoc, Shasta, and Siskiyou Counties.

Pandora moth, *Coloradia pandora* Blake. An outbreak in Tulare and Kern Counties resulted in light to heavy defoliation of 7,500 acres of Jeffrey pine. The infestation has been in progress for 2 years or more and some tree killing has occurred. A survey to determine the infestation trend will be made in 1964. This insect is believed to have a 2-year life cycle in this area, with most of the feeding damage occurring in the odd-numbered years.

Two small infestations were also active in Jeffrey pine in San Diego County.

Jeffrey pine beetle, *Dendroctonus jeffreyi* Hopk. Populations of this bark beetle remained low over most of the State. Significant tree loss continued at four locations in San Bernardino County and one new outbreak developed in Modoc County.

Ips (pine engraver), *Ips* spp. No serious infestations were reported. The low level of damage was believed due to improved host resistance resulting from favorable late winter and spring precipitation and to cool weather during the late spring and early summer.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Tree losses remained low in all areas; however, broods of this bark beetle were numerous in windthrown Douglas-fir in Humboldt, Del Norte, Trinity, and Siskiyou Counties. The windthrow occurred during the Columbus Day storm of 1962, and the insect broods in the down trees may emerge and attack the surrounding green standing trees in 1964.

Red turpentine beetle, *Dendroctonus valens* LeC. Aggressive infestations resulted in occasional tree killing of reserve ponderosa and Jeffrey pine in thinned stands in Mendocino, Modoc, and Lassen Counties. Populations of the red turpentine beetle were high throughout most of southern California, and in some heavily patronized campgrounds preventive measures were taken by spraying the bases of standing trees with lindane.

California flatheaded borer, *Melanophila californica* Van Dyke. Activities of this flatheaded borer have declined except for one infestation in Jeffrey pine in Riverside County and another in San Diego County. The endemic loss condition that prevailed in southern California was believed due to successful maintenance control programs and to favorable precipitation during the year.

Pine reproduction weevil, *Cylindrocopturus eatoni* Buch. Moderate loss of pine reproduction continued with the most noteworthy tree killing occurring in plantations in Siskiyou and Tuolumne Counties.

Lodgepole needle miner, *Recurvaria milleri* Busck. Improvement continued in the appearance of lodgepole pine stands that were aerially sprayed with malathion in 1959 and 1961 in the Tuolumne River Basin of Yosemite National Park. Aerial spraying of 4,500 acres of the infestation in 1963 resulted in 88 percent control. The infestation continued on about 75,000 acres outside of the sprayed areas. Aerial application of malathion on a 450-acre outbreak in Kings Canyon National Park resulted in 62 percent control.

An infestation of a closely related needle miner continued in lodgepole pine at Sentinel Meadows, Mono County.

Spruce budworm, *Choristoneura fumiferana* (Clem.). Midsummer feeding resulted in heavy defoliation of white fir stands in

two areas of the Warner Mountains, Modoc County. However, an egg mass survey in the late summer found reductions of up to 99 percent in the number of eggs laid in 1963 compared with similar egg counts made in 1962. No serious defoliation by this insect is expected in this area in 1964.

Pine needle sheath miner, *Zelleria haimbachi* Busck. Defoliation of ponderosa pines was observed in plantations and natural regeneration over much of central and northern California. An associated tip moth, *Rhyaciona zozana* (Kearf.), caused light feeding damage in many of the same areas.

Sagebrush defoliator, *Aroga websteri* Clarke. This insect pest caused moderate to complete defoliation of sagebrush on over 1 million acres in northern California. The heaviest damage occurred in Modoc and Lassen Counties. The defoliation of bitterbrush, saltbrush, and mountain mahogany was also reported from several locations in this same area. The insects responsible for this defoliation were collected and sent to specialists for identification.

Other insects. Feeding damage by the large aspen tortrix, *Choristoneura conflictana* (Wlk.), on aspen was lower in Modoc County. Outbreaks of the blue-sided tent caterpillar, *Malacosoma constrictum* Stretch, on oak showed a marked decline in Los Angeles and San Diego Counties. Localized infestations of a pinyon sawfly, probably *Neodiprion rohweri* (Midd.), were reported in Los Angeles and Tulare Counties. An outbreak of the fall webworm, *Hyphantria cunea* (Drury), resulted in extensive defoliation of madrone and other broad-leaved trees along the Klamath River, Siskiyou County. Grasshoppers, *Melanoplus* spp., caused heavy defoliation of pine seedlings and other associated plants on small areas in Lake and Fresno Counties. The black pine leaf scale, *Aspidiotus californicus* Coleman, was abundant on sugar pine in several localized areas of northern California.

INTERMOUNTAIN STATES

By R. I. WASHBURN, Division of Timber Management, Ogden, Utah

Conditions in Brief

Losses to forest resources throughout the Intermountain Region from insects continued to be heavy. Only in a few areas does the steadily increasing trend of infestations in the past few years appear to have been halted. Bark beetles were still the worst offenders.

The most troublesome bark beetle pest was the mountain pine beetle. Over 500,000 lodgepole pine trees were infested in several epidemic centers. Both logging and chemical control work were accelerated in an effort to check this insect's spread. While not all epidemics were brought under control, results were encouraging. The trend of other bark beetles varied but was mostly downward. An extensive outbreak of Douglas-fir beetle of long standing in southern Utah appears to have been controlled by natural factors. Another outbreak in southern Idaho was controlled by logging. The Engelmann spruce beetle was at the lowest ebb of activity of any time in the past 10 years. The fir engraver increased in number throughout most of the Region.

The spruce budworn continued to be the most damaging defoliator. Infestations covered over 1.6 million acres in central Idaho. Several large tussock moth outbreaks occurred on a variety of host species in southern Idaho and western Nevada. A leaf tier was still epidemic in many aspen stands throughout the Region, but its damage was somewhat less than in 1962. The pinyon needle scale was widespread in stands of pinyon pine in southwestern Utah and most of Nevada. A geometrid caused heavy mortality to mountain mahogany on important game range in southwestern Idaho. There were localized outbreaks of leaf and needle miners, tube moths, mealybugs, tent caterpillars, cankerworms, aphids, and miscellaneous bark beetles on preferred host trees at many locations in all States.

Control efforts were directed against the mountain pine beetle, Engelmann spruce beetle, Douglas-fir beetle, tussock moth, cankerworms, and the spruce budworm. Significant reductions in mountain pine beetle populations were obtained on the North Slope projects on the Wasatch and Ashley National Forests, Utah and Wyo. Logging and chemically treating infested trees materially reduced the rate of loss of lodgepole pine from mountain pine beetle epidemics on the Targhee National Forest in Idaho and the Teton National Forest in Wyoming; chemical treatment within the Grand Teton National Park in Wyoming also accomplished a considerable reduction of populations. However, substantial increases were recorded in the latter three infestations on most areas outside the treating units.

The Engelmann spruce beetle was controlled by a combination of logging, chemical treatment, and burning on the Upper

Green River project of the Bridger National Forest, Wyo., and on the Aquarius Plateau of the Dixie National Forest, Utah. Logging in the large Douglas-fir beetle infestation on the Sublett Division of the Sawtooth National Forest, Idaho, was continued in an effort to control that infestation.

Suppressive action against the spruce budworm was initiated this year with the aerial spraying of 190,000 acres on the Targhee National Forest, Idaho. A virus was successfully established on 12,000 acres of tussock moth infestation in Douglas-fir on the Boise National Forest, Idaho, by aerial spraying.

Status of Insects

Mountain pine beetle, *Dendroctonus monticolae* Hopk. The mountain pine beetle has caused serious losses in overmature stands of lodgepole pine in the Intermountain Region for many years. Large-scale control projects have been conducted yearly since 1958 against the major infestations now present. In addition, many small outbreaks have been brought under control by timely suppressive action.

Four major control projects were undertaken in 1963 on the Wasatch National Forest, Utah; Teton National Forest and Grand Teton National Park, Wyo.; and Targhee National Forest, Idaho. Infested trees were logged, treated with toxic chemicals, or burned. On the Wasatch National Forest North Slope project, over 500,000 infested trees have been treated by various methods since 1958. The bark beetle population has been reduced to where only 19,000 lodgepole pines are currently infested. The infestations on the Teton and Targhee National Forests and Grand Teton National Park have continued to enlarge and now contain nearly 400,000 infested trees.

A large infestation of bark beetles on Bureau of Land Management and private lands in Sublette County, Wyo., and another on Bureau of Land Management, State, and private lands in Bingham County, Idaho, increased greatly during the year. These outbreaks were estimated to contain over 10,000 trees each, and increasing trends were recorded. Smaller outbreaks on the Cache and Caribou National Forests in Idaho showed increasing tendencies. State, private, and Federal land managers cooperated to suppress aggressive outbreaks in lodgepole pine near McCall, Idaho.

Spruce budworm, *Choristoneura fumiferana* (Clem.). A spruce budworm infestation in southern Idaho has increased in scope and severity each year since 1958. The 1963 infestation covered a total 1.6 million acres of Douglas-fir and true fir timber. Sixty percent of the area was heavily defoliated, most of which has been infested for 3 years or more. Some mature trees and many young trees have been killed in areas receiving repeated heavy defoliation. Throughout the infested areas, tree killing, especially of the understory, is expected to increase because of the accumulated effects of repeated defoliation.

On the Targhee National Forest, Idaho, 190,000 acres were aerially treated with DDT. Dosage rates of ½ and 1 pound of DDT per acre were applied by fixed-wing aircraft and ½ pound per acre by helicopter. An average kill of nearly 97 percent was obtained. Buffer zones along streams were left unsprayed to minimize possible adverse effects to fish and fish food organisms. A cooperative administrative test was conducted on the Salmon National Forest, Idaho, to determine the effect various dosages and methods of application would have on salmon fry and other game fishes.

On the basis of budworm egg mass surveys, the increasing trend of the infestation is expected to continue in 1964, except in the area treated in 1963. Control in 1964 is planned on at least part of the residual infestation.

Tussock moths, *Hemerocampa* spp. Tussock moths continued to be active in two locations, and declined in another, and a sizable new outbreak was discovered. A polyhedral virus was applied by aircraft to 12,000 acres of the large infestation in Douglas-fir on the Boise National Forest, Idaho. The tussock moth has been identified as *H. pseudotsugata* McD. A new outbreak of the same insect was discovered in Owyhee County, Idaho. This outbreak covers several townships of Douglas-fir timber in an area that has been subjected to two previous outbreaks within the last 10 years. A 60,000-acre infestation in the white fir stands of the Humboldt National Forest in northern Nevada declined naturally after about 3 years of heavy defoliation.

Another species, *Hemerocampa vetusta* (Bdv.), became active on bitterbrush near Reno, Nev.

A geometrid, *Anacamptodes clivinaria* (Guenee). An outbreak of this geometrid on Bureau of Land Management lands in the Juniper Mountain area of Owyhee County,

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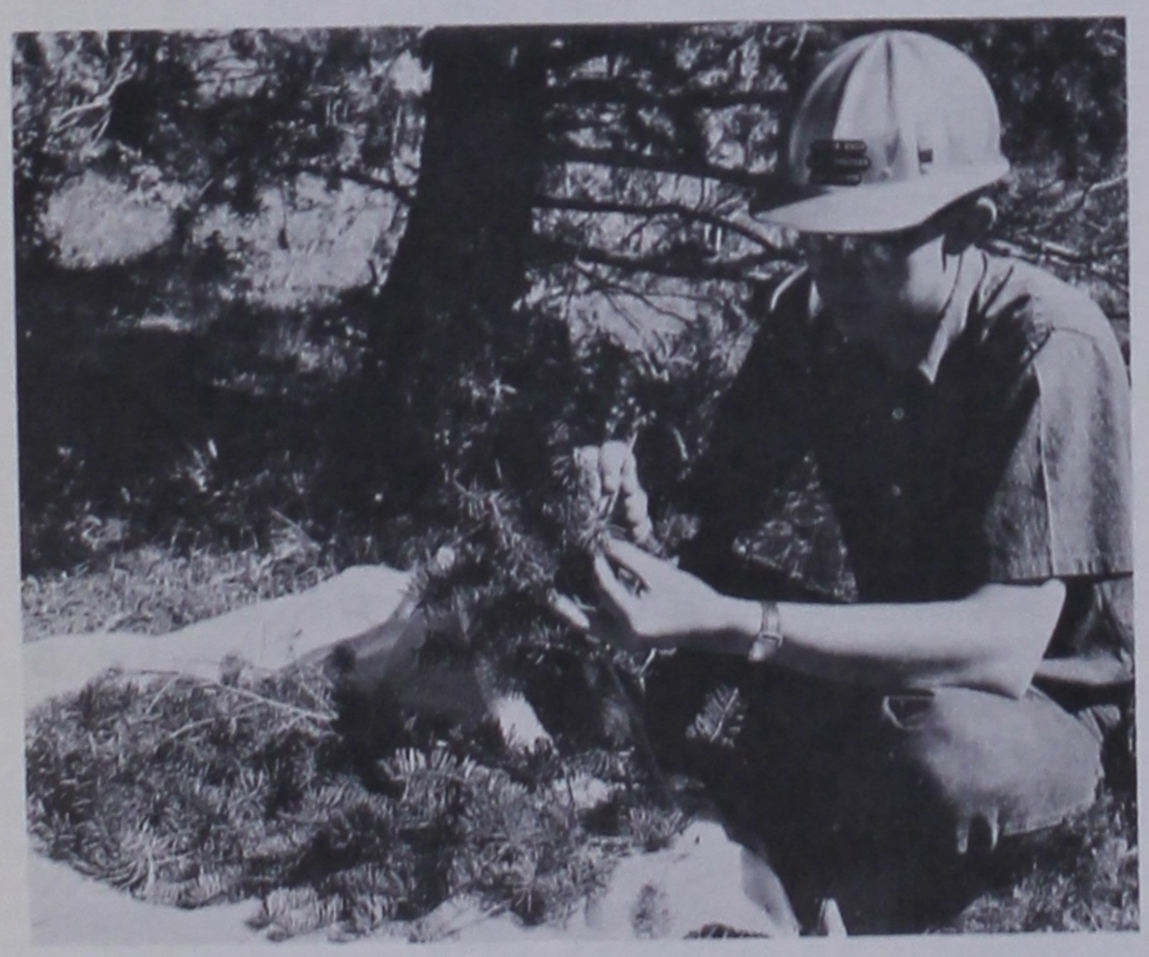
Helicopter application of DDT spray for control of spruce budworm prevents spray drift.



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Spruce budworm larvae are carefully counted on twig samples to assess the effectiveness of spraying for control.

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Tussock moth larvae emerging from a cluster of eggs. Boise National Forest, Idaho.

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Fish-shocking devices for counting purposes were used in Idaho in determining the possible adverse effects of DDT to fish in aerial spraying for control of the spruce budworm.

Idaho, covering several thousand acres of mountain mahogany, was discovered in 1962. Extensive mortality to this valuable browse species has resulted from 2 years of larval feeding. The epidemic is expected to continue at least through 1964.

Fall and spring cankerworms, *Alsophila pometaria* (Harris) and *Paleacrita vernata* (Peck). An epidemic of fall and spring cankerworms has been present on the Wasatch National Forest in Mill Creek Canyon just east of Salt Lake City, Utah, for the last 3 years. Hosts are boxelder, maple, and mountain ash. This year the main recreation area was treated with good success by aerial application of malathion.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Damage caused by the Douglas-fir beetle was considerably less than at any time in the last 10 years. On the Dixie National Forest, Utah, where over 70 percent of the Douglas-fir stands were infested in 1962, the bark beetle population was nearly eliminated by natural factors sometime between late fall and early spring. Throughout most of the remainder of the Region a slight decline in Douglas-fir beetle activity occurred. On the Sublett Division, Sawtooth National Forest, Idaho, logging operations were continued in an effort to bring a large Douglas-fir beetle infestation under control. Several more years of logging will be needed to assure the success of this operation.

Mealybugs, *Puto* spp. Populations of a spruce mealybug, *Puto* sp., continued at epidemic levels within Engelmann spruce stands in southern Utah. The infestations occurred in three separate areas totaling approximately 60,000 acres. Noticeable limb killing has occurred. Mortality of Engelmann spruce reproduction is common within the older infestations. Another mealybug, *P. cupressi* (Coleman), has been epidemic since 1958 on the Payette National Forest, Idaho. The infestation persisted for 2 or 3 years and then nearly disappeared, only to reappear in

other locations a short distance away. The present infestation covers several thousand acres north of McCall, Idaho. Hosts are alpine fir, white fir, white bark pine, and Engelmann spruce. No tree mortality has occurred, and no practical control measures are known.

Aspen leaf tier, *Sciaphila duplex* (Wlsh.). This leaf tier continued to be epidemic in aspen stands in Utah and southern Idaho. Acreages infested by this pest decreased this year, but the infestation still extends over 150,000 acres of commercial stands, recreation areas, and game ranges. Some trees were killed in areas that had been defoliated for 3 consecutive years, but defoliation was generally lighter and damage less severe this year than last. Only a few areas showed heavier defoliation than was experienced in 1962.

Aspen leaf miner, *Phyllocnistis populiella* Chamb. This leaf miner persisted at epidemic levels throughout southeastern Idaho and western Wyoming. Considerable tree deformity and some mortality has occurred in the past few years. No control measures have been attempted.

White fir needle miner, *Epinotia meritana* Hein. A considerable increase in this leaf miner population was evident on the Dixie National Forest and Bryce Canyon National Park in southern Utah. The present infestation covers several thousand acres of white fir timber, much of which was seriously defoliated by the same pest several years ago. Defoliation is expected to be more severe next year and it is likely the infestation will also increase in size.

Pinyon needle scale, *Matsucoccus acalyptus* Herb. The pinyon needle scale caused severe defoliation throughout much of the pinyon pine type of southwestern Utah and Nevada. The infestation is persistent and increased defoliation is expected.

Lodgepole needle miner, *Recurvaria milleri* Busck. There was a general decline in damage over most of the lodgepole needle miner infestations in Idaho, Wyoming, and Utah where some 200,000 acres of lodgepole pine have been infested. Severe defoliation, however, did occur in one infestation on the Targhee National Forest southwest of Pond's Lodge, Idaho.

Great basin tent caterpillar, *Malacosoma fragile* (Stretch). Serious defoliation of aspen, cottonwoods, and several herbaceous plants by the Great Basin tent caterpillar occurred along the Virgin River and in other localized areas in southern Utah. A control program in Zion National Park was successful in reducing the damage to broadleaf trees in the heavily used canyon bottoms. Bitterbrush was the preferred host for this insect in western Wyoming and eastern Idaho. Heavy epidemic populations were present near the Jackson Airport in Grand Teton National Park, and near Featherville, Idaho. Epidemic conditions are expected again in 1964 in southern Utah, western Wyoming, and eastern Idaho.

Engelmann spruce beetle, *Dendroctonus engelmanni* Hopk. Direct control efforts against the Upper Green River infestation, Bridger National Forest, Wyo., reduced the bark beetle population in that area to endemic levels. With one exception, the remainder of the spruce stands in the Region are nearly free of bark beetle activity. The exception is an area on the Dixie National Forest, Utah, where a general increase of the insect was noted in the high-altitude spruce stands east of the town of Widstoe. A previously noted trend toward epidemic conditions in the extensive spruce stands on the Teton National Forest, Wyo., was reversed this year by natural causes.

Fir engraver, *Scolytus ventralis* LeC., and **Western balsam bark beetle,** *Dryocoetes confusus* Sw. Many thousands of true fir trees have been killed by these beetles throughout the Intermountain States during the past few years. Infestations vary from a few acres in size to hundreds of acres. The majority of the affected stands are in rather inaccessible areas and have relatively low economic value. Thus, control of infestations is rarely undertaken except in high-value recreation areas. A definite increase in epidemic activity occurred on the Teton National Forest, Wyo., Humboldt National Forest, Nev., and on the Uinta and Manti-LaSal National Forests in Utah.

Tube moth, *Argyrotaenia* sp. Populations of a pine tube moth declined in the lodgepole pine forests in the Intermountain States. This pest still persists over nearly 200,000 acres in Idaho, Wyoming, and Utah, but damage is expected to decrease in 1964.

Other insects. Several small outbreaks of western pine beetle, *Dendroctonus brevicomis* LeC. flared up in ponderosa pine in southern Idaho. *D. ponderosae* Hopk. activity was at a low level except for small outbreaks close to Price, Utah, and on the Humboldt National Forest near Baker, Nev. *Ips* species were active in local areas of pinyon pine in eastern Utah. Scale insects that were abundant on conifers last year have

now declined. Heavy populations of aphids, species unknown, were recorded on both conifers and deciduous trees throughout the Intermountain States. Epidemic infestations of a spittlebug were present in several juniper stands of southern Utah and on planted lodgepole pine around Pine View Reservoir near Ogden, Utah. Large flights of the sheep moth *Pseudohazis eglanterina* (Bdv.) were observed on the Caribou National Forest, Idaho, where snowberry has been seriously defoliated for the last 2 years.

NORTHERN ROCKY MOUNTAINS

By SCOTT TUNNOCK, Division of State and Private Forestry, Missoula, Montana

Conditions in Brief

Severe epidemics of the Douglas-fir beetle developed in the Flathead National Forest, Mont., and Nezperce National Forest, Idaho. Low-level epidemics continued active in the Kootenai, Gallatin, and Lolo National Forests, Mont., and in the Clearwater National Forest, Idaho. Damage by the mountain pine beetle increased. In Idaho, six infestation centers within white pine stands were detected in the Kaniksu National Forest, parts of 141,000 acres on the Clearwater contained chronic infestations, the St. Joe had an increase in its eastern drainages, and the Coeur d'Alene had continued losses in chronic areas. There was also evidence of this pine beetle in subepidemic numbers in several areas in the Flathead National Forest, Mont. Additionally, about 5,200 acres of infested lodgepole pine occurred on the Kootenai National Forest, Mont.

Fir engraver beetle infestations in true firs were heavy over the Nezperce, Clearwater, and St. Joe National Forests, Idaho, and Flathead National Forest, Mont. Oregon pine ips outbreaks were at a very low level, except in stands of ponderosa pine between Riggins and Grangeville, Idaho, where damage was moderate. The spruce budworm epidemic showed no sign of abatement, but defoliation is not expected to increase in 1964. The moth spread westward into Idaho from the Bitterroot and northward into Montana.

The Douglas-fir tussock moth population increased somewhat in Idaho, and a 1,400-acre Douglas-fir stand was heavily defoliated for the first time near Kalispell, Mont. The larch casebearer epidemic continued to spread through the larch type, reaching as far north as Bonners Ferry, Idaho, as far south as Elk River, Idaho, and as far east as Plains, Mont. The pine needle sheath miner heavily defoliated lodgepole pine within 168,000 acres in western Montana and 4,000 acres north of Bozeman. Larch sawfly damage was heavy. The St. Joe National Forest contained 34 different infested stands ranging in size from 10 to 13,000 acres, and the Clearwater National Forest, Idaho, had 6. A larch bud moth infestation occurred in Montana, the first since 1961. Douglas-fir needle midge populations were heavy in most stands. Damage by the western pine tip moth was evident on 65,000 acres of ponderosa pine in eastern Montana. About 350 acres were infested for the first time by the false hemlock looper near Moiese, Mont. The forest tent caterpillar caused heavy defoliation to deciduous trees and shrubs over 116,000 acres in northern Idaho.

Status of Insects

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Surveys during 1962 indicated that damage by this bark beetle would increase in 1963 over the northern part of the Rocky Mountain States. Severe epidemics developed in the Flathead National Forest, Mont., within the northern parts of the Swan River and South Fork Flathead River drainages, affecting about 46,000 acres. The beetle population maintained a low-epidemic level in the Kootenai National Forest, Mont.; around the Thompson Lakes; within the Fisher River and Wolf Creek drainages; and within almost all drainages northwest of Libby and north of Troy, Mont. Damage in the Gallatin National Forest, Mont., consisted of small groups of trees scattered throughout most of the Douglas-fir type. The heaviest concentration of attacked trees occurred on the Squaw Creek Ranger District. Damage was light in the Lolo National Forest, Mont. About 1,200 acres were infested in the Cottonwood drainage on the Seeley Lake Ranger District.

Another severe epidemic was active in the Nezperce National Forest, Idaho. It extended from Riggins to Grangeville and included about 12,000 acres in drainages on the east side of the Salmon River. Light infestations were spread through about 4,500 acres in the Newsome Creek drainage near Elk City, Idaho. Small groups of infested trees were detected in drainages along the

Selway River from the Fenn Ranger Station to Selway Falls. Infestations continued active on the Powell Ranger District, Clearwater National Forest, Idaho.

Mountain pine beetle, *Dendroctonus monticolae* Hopk. Damage by this beetle increased during 1963. In the Kaniksu National Forest, Idaho, there were six infestation centers in mature western white pine stands. The heaviest killing occurred here within the headwaters of the Priest River and covered about 2,500 acres. About 5 percent of the white pine trees were attacked, and in some sections losses ranged as high as 12 percent. This infestation is expected to increase in 1964. Near the heads of Caribou and Trapper Creeks (northeast of Upper Priest Lake) about 1,500 mature white pine were infested; 9 percent of the white pine trees in a 30-acre stand west of Upper Priest Lake were attacked. Numerous groups of white pine, containing from 5 to 50 infested trees, were detected in the Lion and Bull Creek drainages east of the northern tip of Priest Lake.

Areas of chronic infestations in the Clearwater National Forest, Idaho, within mature western white pine stands, covered about 141,000 acres; 2 to 3 percent of these trees are killed annually by this beetle. The most heavily infested area in 1963 was along the North Fork Clearwater River near Cedars. Aerial surveys indicated that infestations in white pine are increasing in drainages of the St. Joe River, Idaho, from Avery to Red Ives. The Coeur d'Alene National Forest, Idaho, also has several drainages where mature white pine is chronically infested. Numerous groups of infested trees were observed in the Steamboat, Grizzly, Downey, Yellow Dog, and Flat Creek drainages of the Coeur d'Alene River. The Kootenai National Forest, Mont., contains about 5,200 acres of lodgepole pine in the Yaak River drainage that are lightly infested. This infestation has been increasing for the last 3 years. Many groups of white pine were killed during 1962 and 1963 along the northeast and southwest sides of Hungry Horse Reservoir and in the North Fork Flathead River drainage, Mont.

Fir engraver, *Scolytus ventralis* LeC. The long, dry summer of 1961 triggered epidemics of this beetle throughout the grand fir type in the northern Rocky Mountain States. Losses were still high in 1963 on the west half of the Nezperce National Forest, the Clearwater National Forest from the North Fork to the Middle Fork Clearwater River, and the St. Joe National Forest from St. Maries to Bovill, Idaho. Thousands of acres were infested east of Big Fork, and north of Whitefish, Mont.

Douglas-fir engraver, *Scolytus unispinosus* LeC. A light beetle population and a moderate rate of tree killing occurred in an 1,800-acre stand of pole-size Douglas-fir west of Ravalli, Mont. This area suffered heavy losses during 1962.

Oregon pine ips, *Ips oregonis* (Eichh.). Occasional infested areas of ponderosa pine were detected in drainages along the Salmon River from Riggins to Grangeville, Idaho. Four large groups of killed trees surround Rathdrum, Idaho. In western Montana, most ponderosa pine stands contained a few small groups of trees attacked in 1963. Three generations completed development in ponderosa pine logs near Missoula, Mont.

Western balsam bark beetle, *Dryocoetes confusus* Sw. Alpine fir stands in southeastern Montana and Yellowstone National Park, Wyo., have been attacked by the western balsam bark beetle for many years. Thousands of dying alpine firs, probably attacked by this beetle, were detected during aerial surveys in Yellowstone National Park, Pryor Mountains, Custer National Forest, and near the head of the Bighorn River, Mont.

Spruce budworm, *Choristoneura fumiferana* (Clem.). Data collected from permanent plots located in areas of chronic defoliation indicated little change in the regionwide infestation of spruce budworm during 1963. Records for the past 5 years are summarized as follows:

	1959	*1960*	*1961*	*1962*	*1963*
Defoliation (pct.)	38	34	37	25	35
Egg masses per M sq. in. foliage	10.4	4.1	8.4	10.5	9.5
Egg mass parasitism (pct.)	3.8	1.0	4.3	6.0	.0
New foliage growth (in.)	.81	.59	.69	.78	.93
New foliage destroyed (in.)	.31	.20	.26	.20	.32
New length of new foliage (in.)	.50	.39	.43	.58	.61

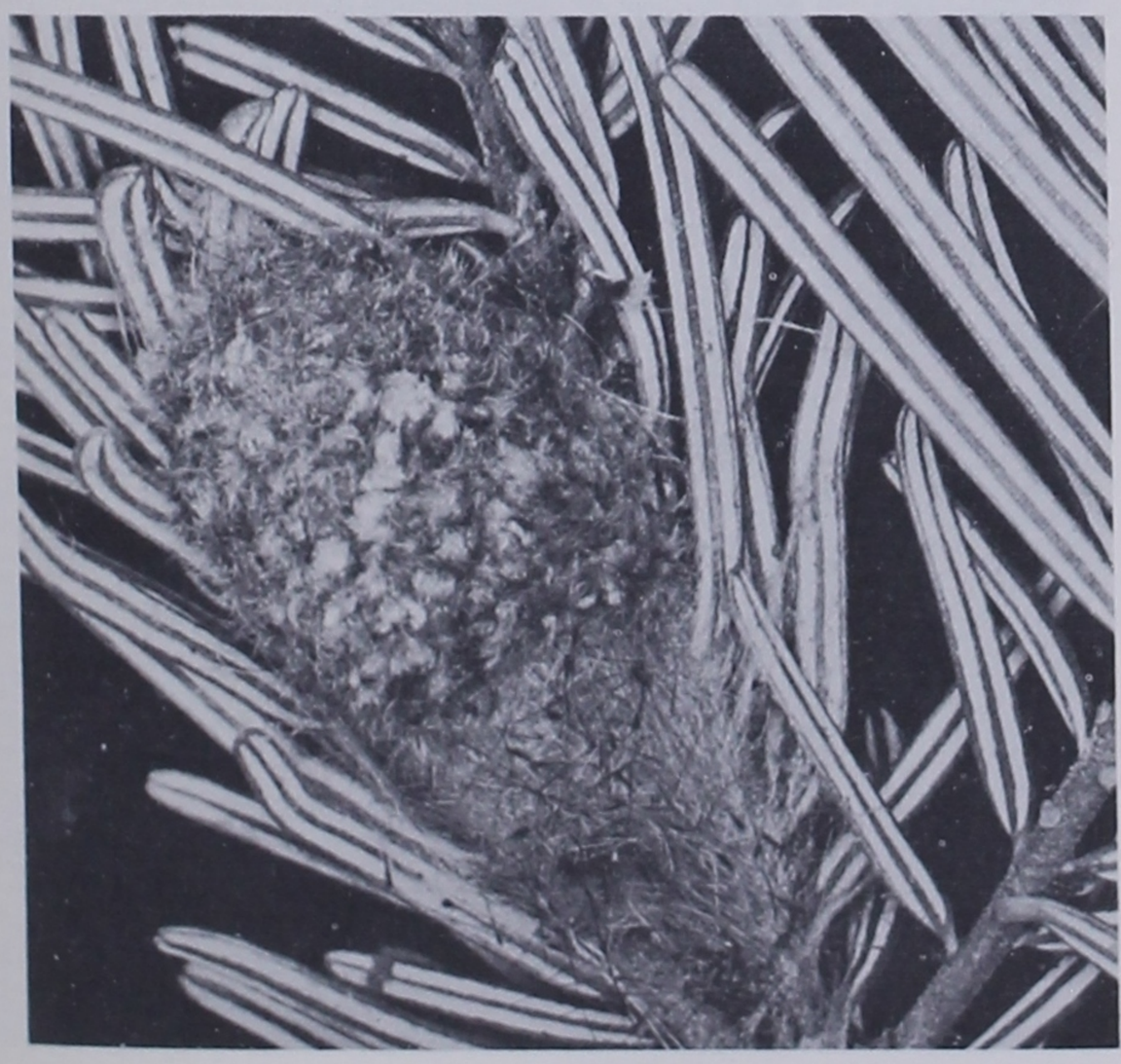
The infestation is static, and there is no indication that it will change its level. The pattern of spread is changing, however. In 1963, budworm damage to host trees extended westward from the West Fork of the Bitterroot drainage in Montana into Idaho as far as the Red River Ranger District of the Nezperce National Forest. It also appears to be spreading northwest in western Montana. A separate small outbreak was detected on the Kootenai National Forest, Mont., and two larger outbreak areas were discovered on the Kaniksu National Forest, Idaho, which extend into Washington. These were all low-level infestations in 1963.

Douglas-fir tussock moth, *Hemerocampa pseudotsugata* McD. Douglas-fir tussock moth infestations have been present around private homes and farm woodlots since 1961 in northern Idaho. In 1963, two infestations were detected in northwestern Montana on forested land. The moth is attacking grand fir, Douglas-fir, and spruce trees. Infestation trends for 1964 are as follows: *Idaho*— Bonners Ferry area, static; Copeland, increase; Clark Fork, decrease; Algoma Lake, increase; Albeni Falls, decrease; Hayden Lake, increase; Coeur d'Alene, increase; and Mineral Mountain, increase. *Montana*— Kalispell, static; and Lion Lake near Hungry Horse, decrease. In all areas except Clark Fork and Mineral Mountain Lookout most of the infested trees in Idaho were sprayed. The infested area near Kalispell covers about 1,400 acres of non-Federal forest land.

Larch casebearer, *Coleophora laricella* (Hbn.). Epidemic infestations of the larch casebearer continued to spread through the larch type in the northern Rocky Mountain States. The forefront of the epidemic has extended as far north as Bonners Ferry, Idaho; east down the Clark Fork River to Superior, Mont.; and as far south as Elk River, Idaho. Tree mortality has not resulted yet from continued heavy defoliation, but radial growth has diminished to about 40 to 50 percent of normal in some areas. Progeny of *Agathis pumilus* (Ratz.) parasites liberated in 1960 were found in 1963 and their population is increasing. Three organic phosphate insecticides were tested against the casebearer during the spring months of 1963 by applying them from a helicopter. All gave excellent control under test conditions.

F—505885

Larvae of the larch casebearer overwinter in cigar-shaped cocoons. The cocoons are made out of mined needles and are fastened near the bases of spurs on the twigs of larch trees.



F—505854

An egg mass of the Douglas-fir tussock moth on top of a tussock moth cocoon.

Larch bud moth, *Zeiraphera griseana* (Hbn.). From 1955 to 1957 this bud moth caused noticeable defoliation in many northern larch stands. It was next detected in one stand east of Libby, Mont., during 1961. In 1963 it severely defoliated sections of larch in Beaver and Little Beaver Creek drainages in the Lolo National Forest, Mont., and probably is scattered throughout many thousands of acres to the south.

Larch sawfly, *Pristiphora erichsonii* (Hartig). For the last 3 years infestations have been increasing in northern Idaho and to some extent in Montana. The St. Joe National Forest, Idaho, contained many infested stands of western larch ranging in size from 100 to 13,000 acres. The most heavily infested area was between Clarkia and Elk River. About 12,000 acres of larch were defoliated in the Clearwater National Forest, Idaho. In Montana, 3,000 acres were detected south of St. Regis in Cedar Creek. Control measures have never been used

against this pest in the northern Rocky Mountains.

Pine needle sheath miner, *Zelleria haimbachi* Busck. Damage has been increasing in most lodgepole and ponderosa pine stands from central Montana into northern Idaho since 1960. A severe epidemic developed in 1963 in lodgepole pine stands north of Whitefish, north and east of Columbia Falls, around West Glacier, the north part of the South Fork Flathead River, and through the southern part of the Swan River Valley in Montana. About 168,000 acres are involved. About 4,000 acres of lodgepole pine in Truman Gulch, Gallatin National Forest, Mont., were also defoliated. Damage to ponderosa pine trees was noticeable near Grangeville, Idaho.

Douglas-fir needle midges, *Contarinia* spp. Since 1957, almost all Douglas-fir stands in Montana and northern Idaho have been infested by two species of needle midges, *C. pseudotsugae* Condr., and *C. constricta* Condr. Heavy damage to current needles was observed in drainages on the west side of the Salmon River from Riggins to Grangeville, and along the South, Middle, and North Forks of the Clearwater River in Idaho. Harvesting of Christmas trees has been reduced on the Kootenai, Lolo, and Flathead National Forests, Mont., because of damage by these pests.

Pine needle scale, *Phenacaspis pinifoliae* (Fitch). This scale was quite noticeable in 1963 in about 1,200 acres of lodgepole pine in Glacier National Park, Mont. Some tree killing was noticed in the area in 1962. Very heavy populations also were present on ponderosa pines south of Missoula, Mont. Homeowners there are considering control measures. Occasional pine trees alongside dusty roads contained moderate populations over most of the northern Rocky Mountain States.

Pine butterfly, *Neophasia menapia* Feld. & Feld. Adults were observed flying around the tops of western white pine and ponderosa pine trees in numerous areas throughout the northern Rocky Mountain States. A heavy population was reported infesting ponderosa pines scattered along the Salmon River, Idaho, but the scope of this infestation is unknown.

Western pine tip moth, *Rhyacionia frustrana bushnelli* Busck. Infestations in eastern Montana seem to be cyclic. Damage to ponderosa pine saplings and reproduction was heavy during 1957 and 1959. It was hardly noticeable for the next few years; then it began to increase in 1962. By 1963 damage was visible from the air on 13,000 acres near Ekalaka, and the Long Pines area, and on 52,000 acres south of Ashland on the Custer National Forest, Mont. West of Ashland, on the Northern Cheyenne Indian Reservation, 26,000 acres were heavily damaged.

False hemlock looper, *Nepytia canosaria* (Wlkr.). It is uncommon for this moth to cause heavy defoliation in the northern Rocky Mountains. However, about 350 acres of Douglas-fir trees were infested in 1963 on the National Bison Range, Moiese, Mont., and an abundant moth flight was observed in September.

Forest tent caterpillar, *Malacosoma disstria* Hbn. Aspen, birch, alder, and willow type stands were heavily defoliated in northern Idaho. About 108,000 acres were infested in the Kaniksu National Forest mainly north and south of Sandpoint. Near Hayden Lake and along the Coeur d'Alene River drainage, nearly 8,000 acres were lightly defoliated. Parasitism of pupae was very high, and it is expected that the epidemic will decrease in 1964.

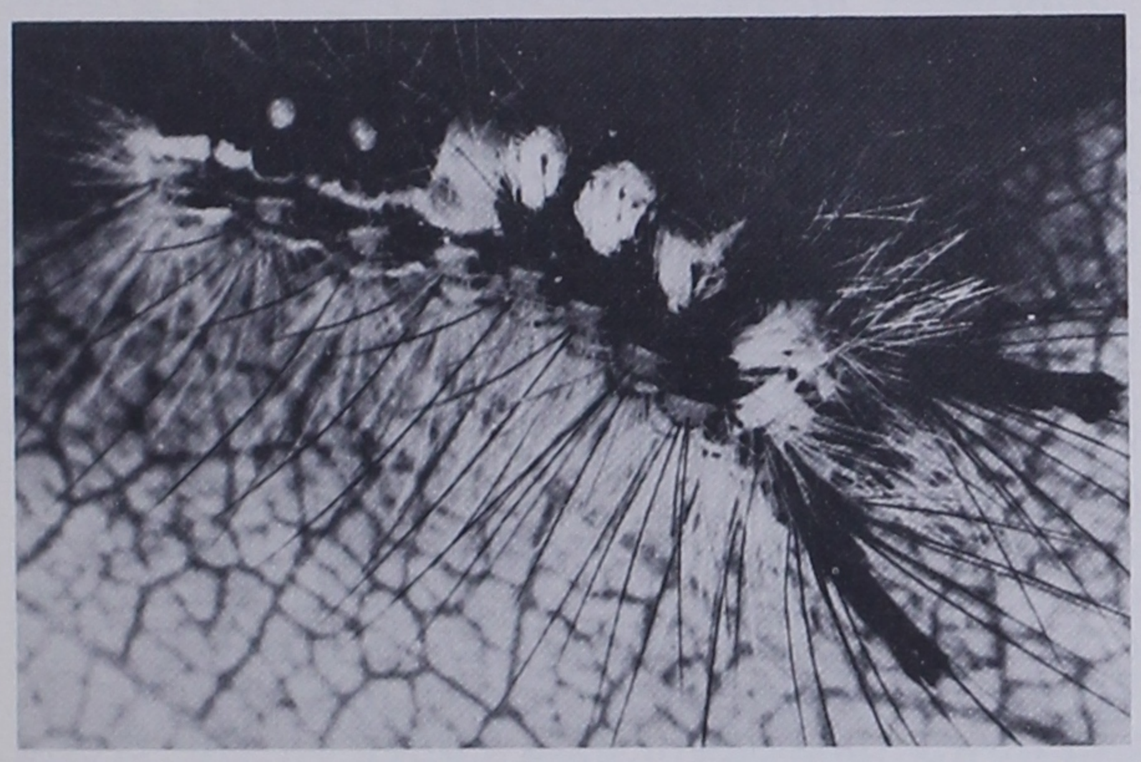
Black spruce borer, *Asemum atrum* Esch. Numerous adults emerged from spruce lumber in a railroad car that was shipped from Superior, Mont., to Iowa.

F–505856

Heavy populations of the pine needle scale occurred on lodgepole pine in Glacier National Park, Mont.

Spruce needle miner, *Taniva albolineana* (Kearf.). A few ornamental Engelmann spruce trees were lightly defoliated in Grangeville, Idaho. This insect was reported at several other locations on single spruce trees.

Rusty tussock moth, *Orgyia antiqua* (L.). Cocoons were found on western larch trees on the Sylvanite and Warland Ranger Districts, Kootenai National Forest, Mont. Damage to host trees was slight. Numerous egg masses were observed on the foliage of many species of brush-type plants on 30 acres located northeast of Missoula, Mont.



F–505857

Larvae of the rusty tussock moth were abundant on the foliage of many species of brush-type plants in the vicinity of Missoula, Mont.

CENTRAL ROCKY MOUNTAINS

By S. W. MESO, JR., and A. E. LANDGRAF, JR., Division of Timber Management, Denver, Colorado

Conditions in Brief

The Black Hills beetle continued as the most important forest insect within the Central Rocky Mountains. An outbreak of serious proportions, the worst in many years, developed in stands of ponderosa pine over an extensive area in the Black Hills of South Dakota and Wyoming. Chronic infestations on parts of the Pike, Arapaho, Roosevelt, San Isabel, and Grand Mesa-Uncompahgre National Forests, Colo., and in the north central part of the Bighorn Mountains, Wyo., were successfully checked, and concerted action by public and private landowners was initiated to reduce and contain the virulent epidemic in the Black Hills.

There were no serious infestations of other bark beetle species anywhere in the Central Rockies. The Engelmann spruce beetle, however, increased in numbers in logging slash and cull logs along the west side of Cameron Pass in northern Colorado, and these populations pose a threat to extensive stands of Engelmann spruce in the Roosevelt National Forest.

The scope and severity of spruce budworm infestations in Colorado forests declined materially from levels attained in 1962. Direct control of the spruce budworm was undertaken on only 5,280 acres of young-growth fir stands, highly prized for Christmas tree production, on the San Isabel National Forest. Infestations of pandora moth caused light damage to stands of lodgepole pine on parts of the Medicine Bow, Roosevelt and Routt National Forests, in Colorado and Wyoming. A new area of infestation, also in stands of lodgepole pine, was discovered northwest of Walden, Colo. Feeding by second-year larvae in 1964 may result in heavier damage in affected areas.

Status of Insects

Black Hills beetle, *Dendroctonus ponderosae* Hopk. Black Hills beetle infestations of varying intensities have occurred in stands of ponderosa pine in the Central Rocky Mountains, and the Black Hills of South Dakota and Wyoming for many years. Those in the Big Horn Mountains of Wyoming also have caused serious cumulative depletion of the forest resource. The severity and intensity of infestations in 1963 varied widely between locations. Those that developed on parts of the Pike, Arapaho, Roosevelt, San Isabel, and Grand Mesa-Uncompahgre National Forests in Colorado were largely contained by cutting, piling, and burning infested trees, and by spraying those not cut and burned with formulated insecticides. Infestations in some areas were thus reduced by as much as 92 percent.

An outbreak of serious proportions, the worst in many years, developed over an extensive area in the Black Hills of South Dakota and Wyoming. The area most seriously affected extends from north of Custer, S. Dak., westward into the Bear Lodge Mountains, Wyo. The attacking beetles in 1963 killed trees in groups varying in number from 2 or 3 to more than 1,000. The volume of loss is estimated at approximately 25 million board feet.

The severity of the epidemic in the Black Hills prompted landowners and land managers to initiate a major campaign to reduce

populations and retard spread. A multiphase action program, consisting of timber salvage, cutting, piling, burning, and spraying infested trees was decided upon, and the control program was begun early in October. Resumption of control operations is planned during the spring months of 1964 with the expectation that a major part of the infestation will be suppressed prior to emergence of new adults in July and August.

Mountain pine beetle, *Dendroctonus monticolae* Hopk. Mountain pine beetle infestations of serious proportions have persisted in stands of lodgepole pine on parts of the Shoshone National Forest, Wyo., for the past several years. The rate of tree killing reached a peak in 1962. The beetle populations were greatly reduced in 1963 by cutting, piling, burning and spraying infested trees. It is anticipated that infestations in affected areas will be brought under control with but limited followup suppression work in 1964.

Engelmann spruce beetle, *Dendroctonus engelmann* Hopk. Engelmann spruce beetle populations throughout the Central Rocky Mountains were reported at the lowest level since 1956. The long-standing outbreaks in stands of Engelmann spruce on the Grand Mesa-Uncompahgre, Rio Grande, and San Isabel National Forests have been brought under control by timely cutting of green spruce trees to trap the attacking adults. A persistent infestation of potential significance along Wolf Creek on the west side of Wolf Creek Pass, San Juan National Forest, Colo., is being contained by use of trap trees and an uninterrupted timber sale. The potential for an outbreak in the Roosevelt National Forest exists because of a current buildup of beetle populations in spruce logging slash and cull logs on non-Federal lands along the west side of Cameron Pass in northern Colorado.

The reduction of Engelmann spruce beetle populations and resultant decrease of infestations in stands of Engelmann spruce in the Central Rocky Mountains is attributed to (1) less timber blown down by strong winds during the past 3 years; (2) increased predation of larval broods by woodpeckers; (3) modified practices of logging in spruce stands to permit the burning of slash and cull logs, and (4) systematic ground inspection of potential problem areas for earlier discovery of incipient outbreaks.

Spruce budworm, *Choristoneura fumiferana* (Clem.). The scope and severity of spruce budworm infestations declined materially throughout the Central Rocky Mountains. Area of defoliation in 1962 was 718,300 acres. In 1963 it totaled 46,880 acres. On the basis of information obtained from budworm egg-mass surveys in July, it seems likely that the severity of tree defoliation in current infestation areas will be less in 1964. The decline of populations was due to unknown natural control factors.

Direct control of the spruce budworm was undertaken in 1963 on the San Isabel National Forest, Colo., on only 5,280 acres of young-growth fir stands that were highly prized for Christmas tree production. Excellent control was attained by helicopter application of ½ pound of DDT per 1 gallon of solution per acre. No adverse effects of spraying were noted or reported.

Pandora moth, *Coloradia pandora* Blake. An infestation of this important forest defoliator has persisted at varying levels of intensity in stands of lodgepole pine along the Colorado-Wyoming border for the past several years. First-year feeding larvae in 1963 again caused light damage to host trees in the general area of older infestations. A new infestation of more severe proportions was discovered in an area northwest of Walden, Colo.

The larval population of the pandora moth on parts of the Medicine Bow, Roosevelt, and Routt National Forests in Colorado and Wyoming, was found to be infected by an unknown pathogen. Its effect on the trend of infestations has not been determined.

Oregon pine ips, *Ips oregonis* (Eichh.). The Oregon pine ips, a periodic pest of ponderosa pine in the Black Hills of South Dakota and Wyoming, caused little damage in 1963. Little or no damage is expected in 1964.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Douglas-fir beetle infestations were at low endemic levels in most stands of Douglas-fir in the Central Rocky Mountains. Tree killing above endemic levels, however, was reported from the Devil Mountain area, and from the north Powderhorn area, southwest of Gunnison, Colo.

Western balsam bark beetle, *Dryocoetes confusus* Sw. Endemic infestations were reported throughout the spruce-fir type in Colorado and Wyoming. No change in infestation levels is expected in 1964.

Great Basin tent caterpillar, *Malacosoma fragile* (Stretch). Large acreages of aspen throughout Colorado often are heavily defoliated by the Great Basin tent caterpillar. Outbreak infestations usually persist for several years before they decline to endemic proportions. A downward trend in persistent infestations in southern Colorado was first reported in 1958, and low popula-

tions in most affected areas continue to date. However, in one area near Cumbers Pass, Rio Grande National Forest, in the vicinity of previous epidemics, an upsurge in populations was reported. In addition, a new outbreak was discovered in 1963 along the West Fork, Cimarron River, Grand Mesa-Uncompahgre National Forests. There is no previous history of severe caterpillar infestations in this location.

Large aspen tortrix, *Choristoneura conflictana* (Wlk.). The scope and intensity of large aspen tortrix infestations increased in southern Colorado in 1962 after a 5-year interim of low-level populations. Light defoliation of aspen occurred again in 1963 on parts of the San Juan, Grand Mesa-Uncompahgre, and Gunnison National Forests.

Pine needle miner, *Recurvaria* sp. This unidentified needle miner has persisted in endemic number in stands of ponderosa pine in parts of Colorado for many years. Damage to host trees was insignificant in 1963. Centers of infestation were reported along State Highway 160, west of Durango, and on Lookout Mountain, west of Golden, Colo.

Other insects. Aspen and birch trees in the Black Hills of South Dakota were heavily defoliated by an undetermined leaf beetle, *Chrysomela* sp. Stands of lodgepole pine northwest of the Shadow Mountain Recreational Area, near Grand Lake, Colo., were lightly infested by an undetermined sawfly. This sawfly infestation has persisted in the same general area for the past several years.

SOUTHWESTERN STATES [1]

By D. D. LUCHT and D. A. PIERCE, Division of Timber Management, Albuquerque, New Mexico

Conditions in Brief

Damage from insects to the multiple use resources of the Southwest was less this year than at any time during the past 5 years. Cultural, direct, and natural controls contributed to this improvement in forest insect conditions.

The threat posed by the major Engelmann spruce beetle outbreak near Taos, N. Mex., has been materially reduced through sale of infested stems and burning of infested down material. An aggressive Black Hills beetle population initially attacked and killed 2,500 limber pine in the Manzano Mountains near Albuquerque, N. Mex. With the limber pine almost eliminated, the beetle started attacking adjacent ponderosa pine. Outbreaks of the Douglas-fir beetle continued throughout the Douglas-fir type. Losses are most severe on the Kaibab National Forest, Ariz.

The spruce budworm continued to be a problem in some areas of the Southwest. This pest was active on 350,000 acres of mixed conifer type on State and private land near Chama and Cimarron, N. Mex. These areas were excluded from the 2-year control program that reduced the 1.1-million-acre infestation to its present level of 350,000 acres in northern New Mexico. In southern New Mexico two new infestation centers totaling 100,000 acres were detected.

Defoliation of aspen by the Great Basin tent caterpillar is becoming a major problem in the Southwest as more emphasis is being placed on recreation values. Land managers received numerous complaints from visitors in 1963 concerning the severe defoliation observed in recreation areas. The most severe defoliation occurred on the North Rim units of Grand Canyon National Park and the Kaibab National Forest, Ariz.

Status of Insects

Engelmann spruce beetle, *Dendroctonus engelmanni* Hopk. Tree killing by this beetle declined in New Mexico and remained static in Arizona. The major outbreak at Lagunitas Recreation Area, Carson National Forest, subsided to very low levels from heavy predation by woodpeckers. The 6-year-old outbreak on the eastern division of the Carson National Forest, Taos, N. Mex., declined in intensity as a result of timber sales and burning of infested cull material. About 3,000 acres of slash and other debris were burned in 1963. The infestation near Flagstaff, Ariz., remains active and is being suppressed by burning of infested cull material.

Spruce budworm, *Choristoneura fumiferana* (Clem.). A total of 566,000 acres of mixed conifer were sprayed to control spruce budworm on Federal and Indian lands in 1963. Of this total, 466,000 acres were located on the western divisions of the Carson and Santa Fe National Forests in northern New Mexico, and 100,000 acres in the Chuska Mountains, Navajo Indian Reservation, northeastern Arizona. This defoliator remained active on 350,000 acres of State and

[1] Includes all forested lands in Arizona and New Mexico and National Park Service land in southern Colorado and western Texas.

private land in northern New Mexico. In southern New Mexico new outbreaks were discovered on the Gila and Lincoln National Forests. These two new outbreaks total about 100,000 acres.

Black Hills beetle, *Dendroctonus ponderosae* Hopk. During the last 5 years this beetle killed most of the limber pine on the Mountainair District, Cibola National Forest, near Albuquerque, N. Mex. With the elimination of limber pine, the beetle is now attacking adjacent ponderosa pine. A ground survey showed more ponderosa attacked in 1963 than in 1962. Thus, it appears that the infestation is gaining momentum.

Great Basin tent caterpillar, *Malacosoma fragile* (Stretch). Defoliation by this caterpillar increased to alarming proportions in Arizona but increased only slightly in New Mexico. The sharpest increase in populations and resulting damage was on 200,000 acres of aspen on the Kaibab National Forest and the North Rim of Grand Canyon National Park. About 1,200 acres of aspen in the Pinal and Huachuca Mountains of southern Arizona sustained heavy to severe damage in 1963. In these areas the caterpillars completely stripped the foliage from aspen at many scenic spots. In addition, the caterpillars themselves were a nuisance. In northern New Mexico aspen on about 100,000 acres sustained varying degrees of damage. Damage was less severe in previously infested areas but increased in the newly infested areas. A reduction in population density and damage occurred this year in the Chuska Mountains of the Navajo Indian Reservation, Ariz.

An unidentified *Malacosoma* species caused severe defoliation to cottonwood and willow in Sabino Canyon Recreation Area, Coronado National Forest, near Tucson, Ariz.

Fir engraver, *Scolytus ventralis* LeC. The 14-year-old engraver infestation in standing white fir on the Sandia Mountains east of Albuquerque, N. Mex., has ended after killing

F–505851

Windrowing and burning infested cull logs and other debris is an effective and economical method for controlling the Engelmann spruce beetle. Carson National Forest, N. Mex.

F–505849

Predation by a jumping spider on larvae of the spruce budworm. Laboratory photo.

about 40 to 60 percent of the stand. Natural factors caused the infestation to decline. A potential danger from this beetle continues to exist, however, as reflected by heavy broods found in green logging slash. The infested down material was burned in late September. An infestation of this beetle remained active in the Mogollon Rim area of the Coconino and Sitgreaves National Forests near Flagstaff, Ariz.

Roundheaded pine beetle, *Dendroctonus convexifrons* Hopk. An outbreak in ponderosa pine at Bonito Lake, Lincoln National Forest, near Ruidoso, N. Mex., remains active with damage less severe this year.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. This pest remains active wherever Douglas-fir occurs in Arizona and New Mexico. Tree mortality was most severe on the Kaibab National Forest, Ariz. Logging is being used, where feasible, to control the pest.

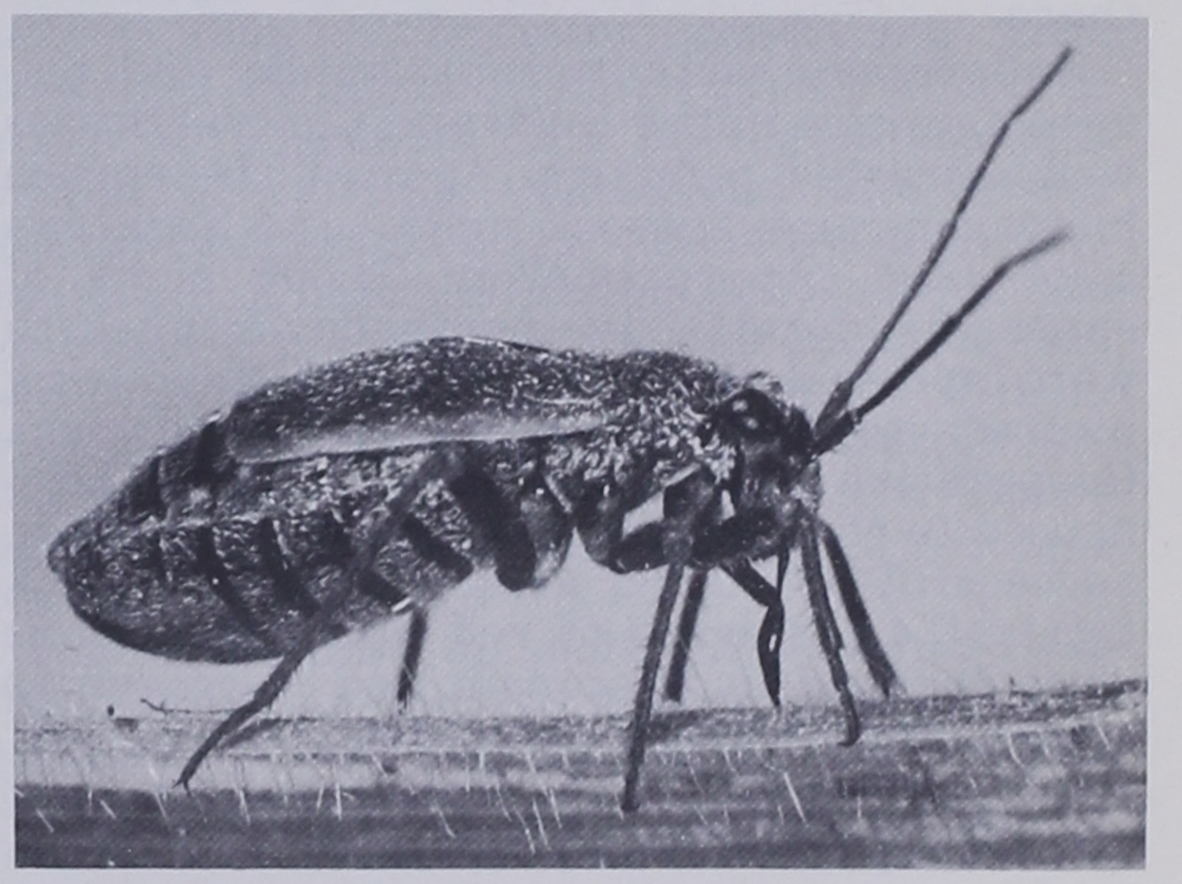
Arizona five-spined ips, *Ips lecontei* Sw. The infestation in second-growth ponderosa pine, Prescott National Forest, Prescott, Ariz., declined to endemic levels in 1963.

Western balsam bark beetle, *Dryocoetes confusus* Sw. Tree mortality remained high in stands of corkbark and alpine fir in New Mexico. Tree killing continued on the Santa Fe National Forest and was severe on about 50,000 acres near Red River, N. Mex.

Pinyon needle scale, *Matsucoccus acalyptus* Herbert. The pinyon needle scale remained active at several National Parks and Monuments in northern Arizona and southern Colorado. In high-use areas at Mesa Verde National Park, 7,300 pinyon trees were sprayed with 0.5 percent dimethoate (cygon). Control was satisfactory. No control is anticipated in 1964.

Douglas-fir tussock moth, *Hemerocampa pseudotsugata* McD. This tussock moth remained endemic throughout the Southwest. Aerial surveys failed to detect any new outbreaks, and none was reported by field personnel.

Grass plant bug, *Labops hesperius* Uhler. This plant bug represents a potential problem on National Forest lands in northern New Mexico. Several thousand acres of rangeland has been planted to crested wheatgrass as a range improvement measure. In 1963 about 16,000 acres of crested wheatgrass were infested. Of this about 5,000 acres were severely damaged, reducing greatly the grazing capacity of the range. This is the first record of this pest causing widespread damage to crested wheatgrass in northern New Mexico.



F–505850

A grass plant bug, *Labops hesperius* Uhler, sucking juices from stem of crested wheatgrass. This plant bug caused serious damage to rangeland on part of the Santa Fe National Forest, N. Mex.

LAKE AND CENTRAL STATES

By D. O. VAN DENBURG,[1] Division of State and Private Forestry, Milwaukee, Wisconsin

Conditions in Brief

In general, population levels of damaging forest insects in the Lake and Central States

[1] Information compiled from reports submitted by Leo Abrahamsen, Minn. Dept. Agr.; Ramon Gass, Mo. Conserv. Comm.; Paul Flink, Mich. Dept. Conserv.; M. K. Idleman, Ohio Dept. Nat. Resources; Prof. E. G. Rennels, Univ. Illinois; Donald W. Renlund, Wis. Conserv. Dept.; Forest Insect Survey Groups of Ontario, Manitoba, and Saskatchewan; Imants Millers, Arland C. Valcarce, Steven O. Ryan, Charles Rexrode, U.S. Forest Serv.

remained at nearly static levels. No increase in extent of the spruce budworm outbreak occurred in stands of spruce and fir in northeastern Minnesota, although egg surveys indicated that an increase in intensity was likely. A new infestation of jack pine budworm was found on the Huron-Manistee National Forests, Mich. The pine tussock moth infestations in Pine and Crow Wing Counties, Minn., were successfully controlled by spraying, but a new infestation of severe proportions in stands of jack pine was reported in Douglas County, Wis. Because of severe winter temperatures, damage from the European pine shoot moth was less intense than in previous years.

Miscellaneous defoliators caused moderate to heavy damage in the hardwood forests of the Central States, but wood borers in living trees continued as the number one problem there.

Suppression activities by public and private agencies in the Lake and Central States were directed primarily against the spruce budworm, pine tussock moth, and Saratoga spittlebug. Approximately 34,000 acres of spruce-fir forests in northern Minnesota were sprayed by helicopter and fixed-wing aircraft to suppress the spruce budworm. Cooperative efforts with the State of Minnesota to control the pine tussock moth were successful on 13,000 acres of jack pine. A total of 4,953 acres of red pine plantations were sprayed in Wisconsin and Michigan to control the Saratoga spittlebug.

Status of Insects

Spruce budworm, *Choristoneura fumiferana* (Clem.). Cooperative aerial surveys conducted during July and August on and around the Superior National Forest, Minn., showed that for the second year there had been no spread of the infestation to the south or east. In general, feeding on balsam fir and white spruce appeared less intense than in the last few years, although greater foliage production, due to favorable growing conditions, could have masked much of the feeding. Egg surveys indicated that high populations can be expected in 1964.

Spruce budworm infestations on approximately 34,000 acres were suppressed in 1963. Control for 1964 has been proposed only in high-use recreation areas of the Superior National Forest.

Jack pine budworm, *Choristoneura pinus* (Free.). Population levels increased drastically on about 35,000 acres in the Huron-Manistee National Forests and adjacent State and private land in Michigan. In some jack pine areas of the Mio District, defoliation has been almost complete; significant top kill and some tree mortality is expected. Extensive moderate defoliation also occurred on State and private land in the central and north central districts of Minnesota.

Jack pine budworm is characterized by rapid and drastic fluctuations of population levels, and no control efforts were needed in 1963. Tentative plans call for the spraying of about 5,000 acres in 1964.

Pine tussock moth, *Dasychira plagiata* (Wlk.). In the latter part of May approximately 4,000 acres of jack pine stands in Minnesota were successfully sprayed to control infestations of the pine tussock moth. During the summer several small localized outbreaks occurred outside the spray areas. Populations appear to be subsiding and no serious trouble is expected in 1964. In Wisconsin, however, an outbreak was found in Bayfield and Douglas Counties, and defoliation was moderate to severe over 17,000 acres. Chemical control has been proposed.

Forest tent caterpillar, *Malacosoma disstria* (Hbn.). Low-level populations have been reported from the Ottawa and Huron-Manistee National Forests, Mich. Light, scattered larval populations occurred on private land along the northern Minnesota border, but defoliation was not noticeable. In many aspen and hard maple stands of northern Michigan, the insects were found in association with other defoliators; actual defoliation was light.

The expected widespread increases of the current Canadian outbreak failed to materialize. Where population declines occurred, they were attributed to late spring frosts that killed larvae both directly and by starvation because growth of foliage was retarded.

Larch sawfly, *Pristiphora erichsonii* (Htg.). With the exception of a few scattered areas in Minnesota, defoliation from the larch sawfly in the Lake States was lighter in 1963 than in the last few years. Canadian entomologists reported that population levels in Ontario were lower than at any time in the past 20 years.

Pine sawflies, *Neodiprion* spp. In general, damage caused by pine sawflies in the Lake and Central States was light in 1963. *N. lecontei* (Fitch) was reported causing light defoliation of jack pine in central and east central Minnesota, and in Emmet and Cheboygan Counties, Mich. Light defoliation of natural and planted shortleaf pine occurred in southwest Missouri. Scattered outbreaks of the European pine sawfly, *N.*

sertifer (Geoff.) were found in areas of Illinois where they had not previously been known. High-level populations were reported still increasing in the Ingham-Clinton County area of lower Michigan. Many private plantations have been sprayed to prevent damage by this insect. *N. pratti pratti* (Dyar) severely defoliated about 100 acres of shortleaf pine on the Athens Ranger District in Ohio. In Illinois populations were much heavier than in 1962, and severe defoliation on several areas may cause some tree mortality.

White pine weevil, *Pissodes strobi* (Peck). Damage to white pine, red pine, and jack pine plantations was more severe in 1963 than in 1962, in areas of north central Minnesota and on the Chequamegon, Nicolet, and Ottawa National Forests. In some National Forest plantations, up to 20 percent of the terminal shoots of main stems were infested. Although still a serious problem in Michigan, the rate of 1963 infestation remained at about the same level as last year.

F–415358

Feeding clusters of the redheaded pine sawfly larvae typify their gregarious nature. Usually these colonies are the offspring of one female. Chequamegon National Forest, Wis.

Pine tortoise scale, *Tuomeyella numismaticum* (P. & M.). Light infestations of this insect have been found scattered throughout the jack pine areas of the Huron-Manistee National Forests; initial indications are that populations are building up. Some severe scattered infestations have been reported from Minnesota where the rate of spread seems unusually rapid. The infestation reported in 1962 on the Stonington Peninsula, Hiawatha National Forest, is being controlled by cutting the infested jack pine. An unusually rapid buildup in a jack pine plantation on the Chequamegon National Forest may require chemical control to prevent tree mortality.

European pine shoot moth, *Rhyacionia buoliana* (Schiff.). Last winter's extremely low temperature caused widespread larval mortality throughout most areas of the Central and Lake States. Population levels, much lower than in 1962, were reported from Michigan and Illinois. The only new infestation was found on the Ontonagon District of the Ottawa National Forest.

Saratoga spittlebug, *Aphrophora saratogensis* (Fitch). Drought conditions that prevailed throughout much of the red pine areas of Wisconsin and Michigan are suspected of causing widespread late instar mortality of spittlebugs. Because of the unexpected population reduction, some areas proposed for control were not sprayed, and both the State of Wisconsin and the Huron-Manistee National Forests reduced their control acreage. Only 1,314 acres of susceptible red pine plantations were proposed for 1964 control.

Nantucket pine tip moth, *Rhyacionia frustrana* (Comst.) Severe winter temperatures apparently reduced tip moth populations throughout the Central States forests. Infestations in loblolly and shortleaf pine were very light in Missouri; Illinois reports that the insect was "pushed" farther south than in previous winters. No change in status is expected during 1964.

Black turpentine beetle, *Dendroctonus terebrans* (Oliv.). Moderate activity was reported on all of the Central States forests. Light to moderate damage was reported in thinned shortleaf pine stands on the Willow Springs, Salem, and Poplar Bluff Districts of Missouri. *D. valens* LeC. caused light damage to residual trees in a red pine thinning on the St. Ignace District, Hiawatha National Forest, Mich.

Ips (pine engravers), *Ips* spp. Throughout the Central States forests, *Ips* spp. have occurred in association with the black turpentine beetle in trees infected by *Fomes annosus*. Scattered attacks have occurred in pulpwood thinning areas, but extreme dry weather reduced brood survival to such an extent that spread has been below expected levels. The heaviest incidence of attack was

found in scorched pine within the Cascade burn area of Wayne and Madison Counties, Mo. No spread to undamaged trees was reported.

Other insects. Light to heavy infestations of the carpenterworm, *Prionoxystus robiniae* (Peck) were reported from many locations in the Central States. This insect continues to be a problem, with heaviest damage occurring in poor-vigor stands on ridgetops and dry slopes. The fall webworm, *Hyphantria cunea* (Drury), was widespread in Missouri, Illinois, Indiana, and Ohio. Roadside hickory and persimmon were the most seriously defoliated, and the damage caused some concern to picnickers and campers. Damage by the elm leaf beetle *Galerucella xanthomelaena* (Schr.) was restricted to ornamental and shade trees throughout Missouri and elsewhere in the Central States. Sporadic attack by the bagworm, *Thyridopteryx ephemereaformis* (Haw.), was reported on both planted and natural redcedar in Missouri; some tree mortality occurred in Christmas tree plantings.

Attacks by a pitch blister moth, *Petrova* spp., are reported as being extremely dense in some jack pine stands on the Stonington Peninsula, Mich. Dead shoots on Michigan red pine, as a result of attack by the Zimmerman pine moth, *Dioryctria zimmermani* (Grote), are still common, but the frequency is below 1962 levels.

Scotch, red, and jack pine plantations have been seriously damaged by the pine root collar weevil, *Hylobius radicis* (Buch.), particularly in western lower Michigan. Because of the high susceptibility of Scotch pine, serious buildups and mortality will probably eliminate many plantations that have grown past Christmas-tree size.

SOUTHERN AND SOUTHEASTERN STATES

By JOHN F. WOOTTEN,[1] Division of State and Private Forestry, Atlanta, Georgia

Conditions in Brief

In most areas of the South and Southeast, southern pine beetle populations declined from the major epidemic proportions of 1962. Two major areas of beetle infestations remained—an outbreak on the Francis Marion National Forest, S.C., and recurrence of an epidemic in southern Louisiana. Other small outbreaks occurred throughout the Gulf area. Extended drought conditions during early summer and late fall in the Southeast favored a buildup of Ips beetles. These insects were particularly noticeable in the 1962 southern pine beetle epidemic areas of the Carolinas. Black turpentine beetle activity continued at previous high levels, with the greatest populations in the Gulf States area.

Heavy mortality of young pines in eastern North Carolina resulted from reproduction weevil attack on plantations up to 5 years old. Defoliation from elm spanworm declined considerably. Dominant factors contributing to a reduction of elm spanworm populations were probably an egg parasite and a late spring frost kill. Forest tent caterpillar defoliation increased substantially in Alabama and Louisiana. The balsam woolly aphid is now known to occur in four of the five stands of native spruce-fir type in the southern Appalachians.

Status of Insects

Southern pine beetle, *Dendroctonus frontalis* Zimm. For the most part, the southern pine beetle declined to a relatively low level in 1963 in the Southern and Southeastern States. Increased activity occurred, however, in the Francis Marion National Forest where an estimated 17,000 trees were killed. In southern Louisiana, the southern pine beetle reappeared for the first time since 1957. Additional localized epidemic spots appeared throughout the 1962 epidemic areas, but none developed into severe problems. The potential for a heavy buildup of the beetle was present throughout the summer, requiring frequent aerial surveys to follow the population trend.

The cause for decrease in southern pine beetle populations is not clear but is credited, at least in part, to low winter temperatures in the Piedmont and to other natural factors, particularly in the Gulf States. Direct control measures were continued to prevent limited epidemic areas from expanding. Suppression projects were continued on a moderate scale in the National Forests of Alabama, Georgia, Mississippi, North Carolina, South Carolina, and Texas, and on non-Federal lands in Georgia, Louisiana, North Carolina and Texas.

Black turpentine beetle, *Dendroctonus terebrans* (Oliv.). This insect continued as the South's most destructive bark beetle on a year-to-year basis, control measures being

[1] Report compiled from information submitted by the Zone Leaders at Asheville, N.C., Macon, Ga., Alexandria, La., and certain State pest control personnel. Mr. Wootten died December 3, 1963, in Atlanta, Ga.

necessary in most areas where active cutting or logging operations were in progress. The beetle was also found associated with southern pine beetle and ips as a secondary invader in parts of North Carolina, South Carolina, and Georgia. The black turpentine beetle was reported to be on a downward trend from the 1962 population level.

Ips (pine engravers), *Ips* spp. Activity by Ips beetles increased throughout the Southern and Southeastern States early in the year but declined with the increased rainfall in early summer. With the return of drought in late fall, the beetles again increased on the east coast. *Ips avulsus* Eichh. replaced the southern pine beetle as a primary invader on the Tyger and Enoree Districts of the Sumter National Forest and in the southern pine beetle fringe areas of North Carolina during September and October.

Pales weevil, *Hylobius pales* (Herbst). Pales weevils damaged several thousand acres of 1-year-old loblolly pine on private lands in Columbus County, N.C. Severe damage was also observed on 2- to 5-year-old trees in the same general area. The weevil was also reported to have destroyed two-thirds of the seedlings in an 8-acre pine plantation on the Croatan National Forest, N.C., which had been prepared the previous fall on a drained, cut-over pocosin site.

Pine sawflies, *Neodiprion* spp. Heavy defoliation of loblolly pine by *Neodiprion taedae linearis* (Ross) was reported near Hampton, Ark. There was light to moderate defoliation near El Dorado and Fordyce, Ark., and on the Noxubee Wildlife Refuge in Winston County, Miss. Pine sawflies were at a low level in North Carolina during 1963. Immature larvae on loblolly pine, probably *Neodiprion taedae taedae* Ross, were slightly more numerous than in 1962 in Craven County, N.C. The Virginia pine sawfly, *N. pratti pratti* (Dyar), was reported from Granville, Vance, Rockingham, and Guilford Counties, N.C. *N. excitans* Roh., reported in the fall of 1962 as having defoliated 4,000 acres of loblolly pine near Gainesville, Fla., continued to feed during the winter in scattered colonies but decreased to a low endemic level with little or no tree mortality occurring.

Balsam woolly aphid, *Chermes piceae* (Ratz.). Surveys to determine the extent of balsam woolly aphid infestation in North Carolina and Tennessee were completed in October. The surveys indicate that this insect is now present in four of the five native spruce-fir stands in the two States. Three centers of multiple-tree infestation were found on Roan Mountain, in addition to the one discovered in 1962. Two areas of infestation were found on Grandfather Mountain and an infestation of approximately 20 acres was detected in an isolated spruce-fir stand near Mt. Sterling in the Great Smoky Mountains National Park. The spruce-fir stand in the Balsam Mountains, N.C., is now the only one in the southeast where the aphid has not been found.

Elm spanworm, *Ennomos subsignarius* (Hbn.). There was an unexpected decline of elm spanworm activity in the southern Appalachian Mountains during 1963–667.000 acres infested compared with 1,451,000 in 1962. Over half of this defoliated acreage, approximately 432,000 acres, was classed as "very light" where damage was restricted to minor shot holes not visible from the air:

Elm spanworm defoliation,[1] 1963, in—

Defoliation	*Georgia (M acres)*	*North Carolina (M acres)*	*South Carolina (M acres)*	*Total (M acres)*
Very light	180	223	29	432
Light	11	197	0	208
Moderate	2	25	0	27
Total	193	445	29	667

[1] No defoliation recorded for Tennessee.

During 1963, the center of defoliation was in eastern Macon County, Swain County, and the eastern half of Graham County, N.C., and in a small area in northern Rabun County, Ga.

Factors responsible for the decline of the elm spanworm included an egg parasite, *Telenomus alsophilae* Vier., which parasitized an estimated 57 percent of the eggs during 1963, and a late spring frost which occurred at the time of egg hatching.

Egg-mass surveys indicate a continued decline in elm spanworm activity for 1964. A small number of egg masses were collected in parts of Swain, Macon, and Jackson Counties, N.C., and in Rabun County, Ga.

Forest tent caterpillar, *Malacosoma disstria* (Hbn.). In 1963 forest tent caterpillar defoliation increased substantially in the Mobile, Tombigbee, and Alabama River sections between Mobile and Jackson, Ala. Aerial surveys covering over one-third million acres of susceptible type revealed that 172,300 acres of water tupelo and sweetgum had been defoliated. This was almost three times the acreage defoliated in 1962. Also, a substantial increase in the area defoliated by this insect occurred in Louisiana, south of Baton Rouge and west of New Orleans.

Walkingstick, *Diapheromera femorata* (Say). The walkingstick was active again in the

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Telenomus alsophilae Veir., a parasite of elm spanworm eggs, is believed to have contributed to a decline in elm spanworm populations in North Carolina.

mountains of Arkansas and Oklahoma. In an aerial survey of the Ouachita and Ozark National Forests in October, approximately 88,000 acres were found defoliated by this insect. Defoliation was heaviest in western Arkansas and eastern Oklahoma. Infestations increased this year on the Kiamichi and Mena Ranger Districts of the Ouachita National Forest, and on the White Rock District of the Ozark National Forest, but declined slightly in some other areas.

Other insects. The fall webworm, *Hyphantria cunea* (Drury), was observed over much of North Carolina and South Carolina, but was less numerous than in 1962. Defoliation by the variable oak leaf caterpillar, *Heterocampa manteo* (Dbldy.), and oak worms, *Anisota* spp., was reported throughout central Louisiana; the Kisatchie National Forest in central Louisiana; the Angelina National Forest Tex.; and other parts of eastern Texas. Heavy infestations of the pine bark aphid, *Pineus strobi* (Htg.), occurred on white pine stands in western North Carolina. An unidentified pine webworm, family Tortricidae, on sand pine caused concern to State and industrial nurserymen in northern Florida.

NORTHEASTERN STATES

By JAMES L. BEAN, Division of State and Private Forestry, Upper Darby, Pennsylvania

Conditions in Brief

The scope and severity of forest insect infestations in the Northeastern States were variable. Some species that are usually unimportant increased; others that normally are more troublesome decreased.

The spruce budworm epidemic in Maine was controlled on 475,000 acres by spraying. A number of hardwood defoliators, including leaf feeders, miners, rollers, and webmakers were reported on the increase in many localities. In contrast, the saddled prominent,

the pitch pine looper, the linden looper, and the forest tent caterpillar declined.

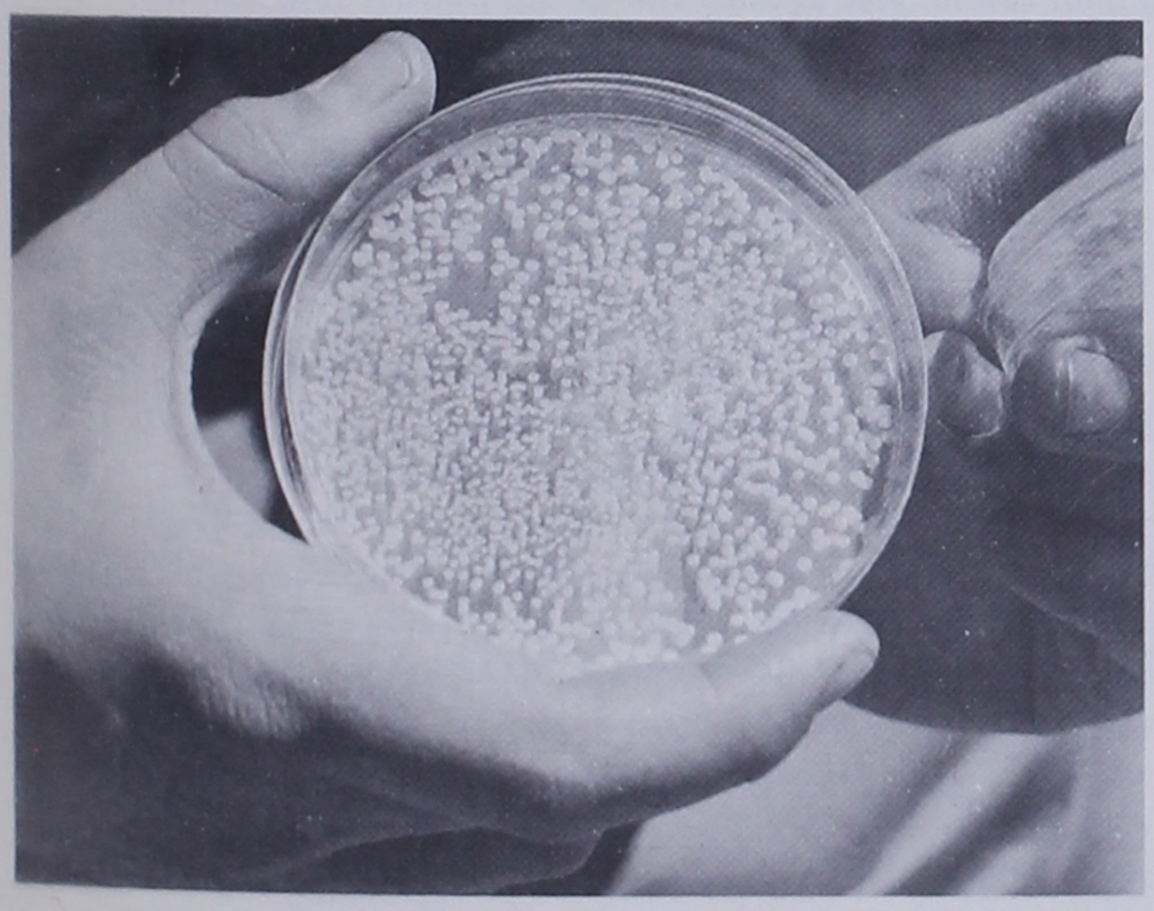
The beech scale, and the associated *Nectria* fungus, continues as a serious threat to mature beech stands in Maine, New Hampshire, Vermont, and New York. The white-pine weevil, balsam woolly aphid, red pine scale, and various shoot moths remain at damaging levels.

With the exception of the spruce budworm project in Maine, most control efforts were limited to small spot infestations with satisfactory results. Additional releases of the balsam woolly aphid predator, *Laricobius erichsonii* Rosenh., were made in Maine and Vermont. This predator is now firmly established in most previous release areas.

Status of Insects [1]

Spruce budworm, *Choristoneura fumiferana* (Clem.). Severe defoliation in 1963 of 475,000 acres of spruce-fir in northeastern Aroostook County, Maine, by the spruce budworm was averted by aerial spraying with DDT. Spray dosages involving ½ pound of DDT in ½ gallon of oil per acre were applied twice over most of the infested area, with a proportionately smaller acreage at 1 pound of DDT in 1 gallon of oil per acre sprayed once. The double application was used where red spruce formed a major component of the stand, since the delay in bud development on red spruce requires a second treatment to assure maximum budworm control. Control of the budworm was reported as 97 percent on balsam fir and 88 percent on red spruce. Aerial and ground surveys indicate that approximately 50,000 additional acres will need treatment in 1964 to prevent further defoliation and growth loss.

A pilot test for control of the spruce budworm with a commercial preparation of the microbial insecticide, *Bacillus thuringiensis* Berliner (Thuricide 90T), was carried out in budworm infested stands near Oxbow, Maine. Two dosages of the preparation (½ and 1 gallon) were mixed with various amounts of water and water-oil diluents and applied by helicopter to a series of 63-acre plots. Preliminary review of data show that some degree of control was obtained, but it was not sufficient to be considered successful.



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Agar plates were used to measure spray droplet distribution of *Bacillus thuringiensis* in a pilot test for control of spruce budworm in Maine. *Bacillus* colony growth illustrated above.

Forest tent caterpillar, *Malacosoma disstria* Hbn. Populations of the forest tent caterpillar continued to decline over most of the Northeastern States with scattered local increases noted. Noticeable feeding was reported from northern Maine and Rhode Island. This is the first time that this insect has been observed in significant numbers in Rhode Island.

Linden looper, *Erannis tiliaria* (Harris). Expected heavy defoliation by this looper throughout the Northeast did not materialize, although some localized heavy defoliation was noted in Vermont. The decline was due primarily to a high incidence of a "wilt" disease and heavy larval parasitism. A continuing decline in populations, regionwide, is expected.

Fall and spring cankerworms, *Alsophila pometaria* (Harris) and *Paleacrita vernata* (Peck). Populations of this defoliator complex remained at an endemic level throughout most of the Northeastern States. Localized defoliation, ranging from 25 to 50 percent, primarily by the fall cankerworm was observed in Pennsylvania on oak, hickory, elm, maple, and beech. However, the late spring frost resulted in a marked decrease in populations. About 930 acres of cankerworm infested oak-hickory forest on the Jefferson National Forest, Va., were treated in May with DDT applied by helicopter at the rate of 1 pound of DDT in 1 gallon of final spray mixture per acre. Excellent control was obtained.

Pitch pine looper, *Lambdina athasaria pellucidaria* (G. & R.). This looper, a close relative to the hemlock looper *Lambdina fiscellaria fiscellaria* (Guen.), has occurred in outbreak proportions on pitch pine over

[1] Report compiled from information submitted by the Eastern Region's Northern and Southern Zone Entomologists and by State cooperators.

F–505828

A helicopter was used to spray *Bacillus thuringiensis* in a pilot control test against the spruce budworm in Maine.

much of Cape Cod, Mass., and in parts of Connecticut, at periodic intervals for many years. The previous outbreak on Cape Cod, Mass., began in 1953 and was ended in 1955 by an aerial application of DDT. In 1961 a buildup of looper populations was again noted and heavy defoliation occurred in 1962. Aerial and ground surveys indicated extensive defoliation for 1963. Instead, a sudden decline in larval population occurred. Although a polyhedral virus was found to be quite active in the second and third larval instar, the virulence of the virus and its effect on the population was not determined. Indications are that the looper is now on the decline.

A looper, *Phigalia titea* (Cram.). Defoliation by this looper was again evident on a 1,000-acre tract of oak-hickory forest on the George Washington National Forest, Va., heavy defoliation having occurred in this area the previous year. Similar defoliation is to be expected in the spring of 1964 but not of sufficient importance to warrant suppressive action. The looper was also reported as abundant on oak in Lackawanna County, Pa.

Fall webworm, *Hyphantria cunea* (Drury). Defoliation by this webworm was common over the Northeast. In Vermont heavy 1963 defoliation was observed throughout the Connecticut River Valley. The localized heavy infestations along the Blue Ridge Parkway, Va., were sprayed in mid-July with mist blowers using a DDT emulsion. Adequate control was achieved.

Orange-striped oakworm, *Anisota senatoria* (J. E. Smith). Epidemic populations of this defoliator were present on thousands of acres of scrub oak in southeastern New Jersey, and in southern Pennsylvania defoliation up to 20 percent was reported on several hundred acres of mixed oak. Very light and scattered defoliation was observed in Rhode Island.

Saddled prominent, *Heterocampa guttivitta* (Wlk.). The localized but significant out-

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Spruce budworm larvae were carefully analyzed for *Bacillus* infection after spraying in the pilot control test in Maine.

break of this defoliator which has persisted for the last 2 years in Berkshire County, Mass., finally subsided. High parasitism and predation of the pupae were mainly responsible for the decline. The past history of this pest indicates that most outbreaks last only 2 to 3 years and occur at rather constant 10-year intervals.

Gypsy moth, *Porthetria dispar* (L.). Aerial spraying programs by the States and the Agricultural Research Service of the USDA were continued this year in an effort to suppress gypsy moth populations in Massachusetts, New York, New Jersey, and Pennsylvania. Approximately 153,360 acres were treated in New York, 109,000 acres in Massachusetts, 10,040 acres in Pennsylvania, and 70,000 acres in New Jersey. Local control measures were undertaken in Rhode Island where damage was serious enough to warrant it. Although heavy defoliation occurred in New Hampshire and Vermont a virus disease and heavy parasitism caused a marked drop in populations. In Vermont experimental aerial application of Sevin and Zectran at 1 pound and 2 ounces per acre, respectively, achieved a high degree of control of third and fourth instar larvae.

Aerial and ground surveys showed a general decline in gypsy moth population in Maine, Rhode Island, and Connecticut, and in parts of Massachusetts and New York. Increased activity was noted in New Hampshire, Vermont, and Massachusetts (88,000 acres either partially or completely defoliated, with some of these areas reported as having 20,000 to 25,000 egg masses per acre). Local areas of infestation were also observed in New York and in the northern part of New Jersey and Pennsylvania. Egg masses were collected in Northampton County, Pa., for the first time.

Red-headed pine sawfly, *Neodiprion lecontei* (Fitch). This sawfly poses a continual threat to young hard pine plantations throughout the Northeast. In Vermont, New York, Penn-

sylvania, Delaware, Virginia, and West Virginia increased population trends were noted. Defoliation, ranging from 10 to 75 percent in some areas, was reported from Pennsylvania and Vermont with some tree mortality. Population levels continued low and static in New Jersey, Maryland, and Kentucky. In New York a small plantation was treated with a 4 percent solution of lindane with good results. The polyhedral virus disease of this sawfly is now being stockpiled in the Eastern Region for future control needs.

Larch sawfly, *Pristiphora erichsonii* (Htg.). Moderate to heavy defoliation of native as well as exotic larch was reported from Maine, New York, and Pennsylvania. A large pole-size stand of European larch in Jefferson County, Pa., was 50 percent defoliated by this sawfly. Japanese larch was also moderately to heavily defoliated in other parts of the State. New York has undertaken a special study to assess the affects of parasitism on overwintering populations. Preliminary results indicate that a high percentage of overall parasitism occurs during the overwintering period.

Miscellaneous defoliators. Defoliation by the Virginia pine sawfly, *Neodiprion pratti pratti* (Dyar), reported to be increasing in Delaware, but on the decline in Maryland, Virginia, and Kentucky. Light to moderate defoliation by the European pine sawfly, *Neodiprion sertifer* (Geoff.), was noted in Maine, New York, and Pennsylvania. The yellow-headed spruce sawfly, *Pikonema alaskensis* (Roh.), is on the decrease in New York; however, previously damaged white spruce plantations are now experiencing tree mortality. Several hundred acres of pine were defoliated by *Neodiprion pinirigidae* (Nort.) in southeastern New Jersey where populations were described as light to heavy and scattered. Oak leaf rollers, mainly *Argyrotoxa semipurpurana* (Kerf.), are common throughout the southern half of the region. These insects appear to be on the increase in New Jersey especially in Cumberland, Salem, Somerset, and Sussex Counties. Defoliation of red, black, and scarlet oak in Pennsylvania ranged from 10 to 35 percent until a late frost prevented further feeding. Populations are now believed to be on the decline.

Reports from Maine indicate increasing damage by the birch casebearer, *Coleophora salmani* Hein., in northeastern Aroostook County, and heavy defoliation by an undescribed oak leaf miner, probably *Profenusa* sp., in the southeastern section of the State. Heavy defoliation by the larch casebearer, *Coleophora laricella* (Hbn.) was noted around the base of Mt. Philo, in Vermont, while defoliation by the Asiatic oak weevil, *Cyrtepistomus castaneus* Roel., and the willow flea weevil, *Rhynchaenus rufipes* LeC. caused concern in numerous areas in Pennsylvania. Defoliation damage by the elm leaf beetle, *Galerucella xanthomelaena* (Schr.), was reported common throughout Rhode Island, where infestation levels have increased.

European pine shoot moth, *Rhyacionia buoliana* (Schiff). This insect continues to be a serious pest of red and jack pine plantations in Pennsylvania, Maryland, and Delaware. Damage was especially severe in a jack pine plantation in Northampton County, Pa. Some relief was obtained because of the severe cold of last winter; however, damage to plantations in some areas remains severe.

Tip moth complex, *Rhyacionia frustrana* (Comst.) and *R. rigidana* (Fern.). The tip moths continue to stunt and deform loblolly, shortleaf, pitch, and Virginia pines throughout the southern part of the Northeastern States. Severe damage was evident in pine plantations in New Jersey, Delaware, and Pennsylvania. Static populations continued in Maryland, Virginia, and Kentucky. The protection afforded the larva by feeding within the buds and tips make chemical control very difficult and expensive. It has been noted, however, that trees growing on good sites seem to outgrow tip moth injury and develop into usable forest trees. General observations also indicate that injury occurs more often on planted pine than on natural regeneration.

Red pine scale, *Matsucoccus resinosae* B. & G. This scale is a major pest of red pine in southwestern Connecticut and southeastern New York. A survey of the present distribution of this insect showed little change in the general range since 1962. Surveys by New Jersey revealed no evidence of the scale in that State. Special surveys will be conducted this fall by New York and Connecticut to determine localized changes in the range of the scale and population intensities.

Beech scale-nectria, *Cryptococcus fagi* (Baer.), and *Necteria coccinea* var. *faginata*. This insect-disease complex continues to be a serious problem in mature beech stands in Maine, New Hampshire, and New York. Mortality of mature beech in northern Maine from newer infestations has increased. Localized increases were reported from southwestern Maine and New Hampshire where beech is reaching merchantable size.

Heavy scale infestations have been commonly found in Vermont and Massachusetts wherever pole or mature beech is predominant, but to date, nectria infections have not been frequently associated with the scale.

In New York the scale is considered to be more active in 1963 than it was in 1962. Mortality of beech from the combined scale and nectria attack is most common in the Catskills; however, isolated areas of nectria infection have been reported as far north as southern Albany County. Beech scale has been found in several localities on the Pocono Experimental Forest in northeastern Pennsylvania, but no nectria cankers were observed. This infestation was first reported in 1958. Proper forest management practices designed to remove mature and overmature beech has aided materially in reducing losses due to this insect-disease complex.

Pine leaf aphid, *Pineus pinifoliae* (Fitch). Damage by this aphid is on the increase throughout the northern part of the Northeastern States, and is commonly found wherever mixtures of red and black spruce and white pine grow in close proximity to one another. Moderate to heavy infestations have been reported from Maine, New Hampshire, Vermont, and New York. Some tree mortality is now occurring and more is expected in those areas where 1963 drought conditions have been severe. Considerable effort is being expended by several States and the Northeastern Forest Experiment Station in developing effective control measures. Results to date indicate that proper timing of the control application is essential to its success. Other studies by Federal and State agencies have provided valuable information on insect-host relationships.

Balsam woolly aphid, *Chermes piceae* (Ratz.). This insect recurs annually as a major pest of balsam fir in Maine, New Hampshire, and Vermont. Tree mortality as a result of heavy aphid attacks was reported in each of these States during 1963. Infestations in Maine remained about the same with some local increases. Aphid damage was most serious in central and southern New Hampshire, especially in mature balsam fir stands. Local increases were noted on the White Mountain National Forest in New Hampshire, and in Vermont. For the past several winters temperatures of more than 30° below zero have helped to reduce aphid infestations in the Northeast.

A small number of adults of the predacious beetle, *Laricobius erichsonii* Rosenh., were liberated in Maine and Vermont. A complete evaluation of this predator introduction program is now underway.

The infestation on Fraser fir in the Shenandoah National Park, Va., remained unchanged. Damage is limited to gouted twigs with a few trees dying annually.

White-pine weevil, *Pissodes strobi* (Peck). Numerous reports of the white-pine weevil showed that this insect was still the most serious deterrent to the production of white pine in the region. Increased weevil damage was noted throughout the Northeast, with heavy localized damage reported from New Hampshire, Rhode Island, New York and New Jersey. In New York weevil damage to Douglas-fir is causing concern to Christmas tree growers.

Control efforts against the weevil were continued during the year; various formulations and methods were used. Results ranged from excellent control to poor. Field tests of a white-pine weevil control planning guide developed by the Northeastern Forest Experiment Station have been initiated. The proposed guide is designed to answer three important questions: (1) if and when control will be needed, (2) number of control treatments required to produce a desired number of crop trees, and (3) where weevil control will be profitable.

Pales weevil, *Hylobius pales* (Herbst). The pales weevil has caused over 10-percent mortality of young Douglas-fir on 15 acres in Pennsylvania. In Maryland weevil damage was reported on the increase because freshly cut-over areas had been planted under an improvement program. Serious damage to seedlings following timber sales to release eastern white pine occurred on the George Washington National Forest, Va.

Southern pine beetle, *Dendroctonus frontalis* Zimm. An active infestation of this beetle was observed in Sussex County, Del., on loblolly pine, while scattered localized infestations were reported from Virginia. Quick salvage and the low winter temperatures in 1962–63 were mainly responsible for holding this beetle in check. *Ips* beetles are now associated with many of the southern pine beetle infested trees.

Miscellaneous insects. Severe damage to plantation red pine by the Saratoga spittlebug, *Aphrophora saratogensis* (Fitch), was observed on the Massabesic Experimental Forest in Maine. Damage has been most apparent where a dense ground cover of sweet fern is associated with low-vigor red pine. A pit-making oak scale, *Asterolecanium* sp., caused severe dieback of white and chestnut oak in New York and Pennsylvania. In Franklin County, Pa., 40 to 50

percent of the chestnut oaks have noticeable symptoms of scale attack. Damage by this insect is expected to increase because of the abnormally dry conditions.

The tuliptree scale, *Toumeyella liriodendri* (Gmel.), was common in most yellow-poplar stands in New Jersey. During August in Hunterdon County about 90 percent of the early crawler stage were found parasitized. Increased activity of the black turpentine beetle, *Dendroctonus terebrans* (Oliv.), was reported from all parts of Delaware and in the Piedmont area of Virginia. This increase is believed to be associated with the current drought. Sugar maple reproduction in Vermont has shown indications of ambrosia beetle (probably *Corthylus punctatissimus* Zimm.) attack. In the Duxbury area nearly all of the young maples ¼ to 1 inch in diameter were or have been infested. If attacked trees survived, considerable root or stem decay resulted.

ALASKA

By DAVID CROSBY, Division of Administrative Management, Juneau, Alaska

Conditions in Brief

The forests of Alaska were not seriously affected by forest insects in 1963. Although critical infestations of the black-headed budworm and the hemlock sawfly occurred at scattered locations in coastal areas, they were not considered an immediate threat to the forest resource. Bark beetles and other species of defoliating insects occurred only in endemic numbers.

Status of Insects

Black-headed budworm, *Acleris variana* (Fern.). This important forest insect was very active in stands of western hemlock north of Frederick Sound, on the northern half of Prince of Wales Island, and at one location near Valdez. Trends of infestations were also upward at many other locations throughout southeast Alaska. On the basis of egg sampling during the fall months, increased populations and resultant heavy defoliation in 1964 are predicted only in areas near Juneau, Sitka, and the southern part of Admiralty Island.

The pilot control test against the black-headed budworm in Alaska, to gain operational experience in aerial spraying from water-based aircraft, was completed as planned. Results of the test indicated that fixed-wing aircraft and helicopters were well suited for operations from a floating camp and water-based installations.

Hemlock sawfly, *Neodiprion tsugae* Midd. There was a moderate increase in populations of the hemlock sawfly in areas north of Frederick Sound. However, there were no significant recoveries of sawfly eggs in affected areas during the fall months; so there is little likelihood of heavy infestations in 1964.

Sitka spruce beetle, *Dendroctonus obesus* (Mann.). The Sitka spruce beetle was reported from central Prince of Wales Island and from a point near Petersburg. Only a few trees were killed at each location, and infestations were not viewed as serious.

Alaska spruce beetle, *Dendroctonus borealis* Hopk. The expected increase in populations of the Alaska spruce beetle failed to materialize, and the rate of tree killing in stands of white spruce was below that of 1962.

Cedar bark beetle, *Phloesinus squamosus* Blkm. The cedar bark beetle continued active in some stands of Alaska-cedar. Tree killing, however, was confined to poor sites and low-value trees.

Unidentified malady of white spruce and mountain hemlock. An unexplained discoloring and loss of needles occurred on several hundred acres of white spruce at Mt. McKinley National Park and on adjacent areas in the Kenai Peninsula. Similarly, unexplained browning and loss of foliage occurred on some 200 acres of mountain hemlock south of Portage on the Anchorage to Seward Highway. In the latter area there were instances where all the vegetation beneath the affected trees died.

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